July 31, 1919 American Machinist Vol. 51, No. 5

With the constantly increasing use of internal-combustion engines and the steadily rising cost of the fuel needed to operate them the problem of preventing waste of energy assumes huge proportions. One prolific source of trouble in this respect is the loss of compression due to leakage around the piston, and one of the many devices intended to minimize this evil is herewith illustrated and described.

A PISTON ring for internal-combustion and other engines which embodies features somewhat out of the ordinary is being manufactured by the Yale Piston Ring Co., 560 West 36th St., New York City.

This ring, as may be seen from the section shown above is made in two parts; an outer part of soft gray iron performing the usual function of piston rings, and an inner ring of tempered steel which furnishes the tension necessary to hold the outer part in contact with the cylinder walls and also serves to keep the ring in contact with the sides of its groove in the piston, thus preventing the leakage of gas past the piston that would inevitably occur with the ordinary form of ring as soon as the latter had worn the least bit loose or was badly fitted to the groove in the first place.

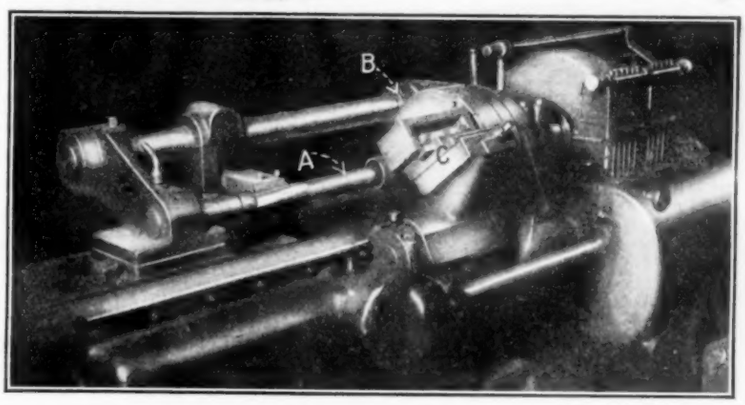


FIG. 1. BORING, TURNING AND CUTTING OFF RINGS

Another advantage derived from this construction is that worn rings may be reground on their edges, the grooves faced, and the ring still retain its seal.

The outer ring, (for each part is a complete circle except for the cut that allows it to expand,) resembles upon casual inspection an ordinary gray-iron piston ring. There are, however, three essential differences: First, as the ring is not required to exert pressure of itself it may be made of the softest gray iron obtainable; second, for the same reason, the outer diameter is ground to the same size as its cylinder instead of from $\frac{1}{64}$ to $\frac{3}{64}$ in. larger as in the case of the snap ring, and third, the inside of the ring is not parallel with the outer surface but is bored taper, or at an angle of 15 deg.—consequently the ring has one thick edge and one thin one.

The inner ring is of tempered steel and is of a section complementary to the outer one; that is, its tapered or beveled surface is on the outside, and when the steel ring is pushed into the gray-iron one its tension not only holds the latter against the cylinder walls, but also, by reason of the two beveled surfaces coming together the iron ring is pressed against one side of the groove and the steel one against the other side, forming a sort of automatic adjustment for maintaining the width.

The usual form of one-piece, or snap-ring, must be made of comparatively hard iron to give it resilience; it is then turned somewhat larger in diameter than the cylinder in which it is to run and, after having a piece cut out of it equal to the difference between its circumference and that of the cylinder bore, it is forcibly closed in and held upon a mandrel in the closed position while being ground to fit the cylinder. When placed in the cylinder it hugs the wall of the latter by virtue of its tendency to resume its original size.

While a well made ring of this kind will form a fairly good joint around its entire circumference, the greater part of its pressure is delivered at three points—the

ends of the ring next to where it is cut, and the point directly opposite the cut. The tendency of this unequalized pressure is obviously to wear the cylinder out of round.

There have been many attempts to overcome the defects of the snap ring, but its simplicity of construction and freedom from other troubles which are usually introduced with the more complicated rings have enabled it to retain its popularity, and it is in use in by far the larger portion of gas engines of comparatively small cylinder bore.

One of the advantages claimed for the Yale ring is that it can be made from softer iron than the snap ring, imposing the wear upon the ring instead of the cylinder, making possible a much longer life for the latter. It is a comparatively easy and inexpensive job to replace a wornout ring while it is quite another matter to rebore a scored or worn cylinder.

The outer or gray-iron part of the Yale ring is made from pot castings of the usual form and the first step in production is the reduction of these pots to rings, an operation accomplished by means of Potter & Johnston piston-ring machines, one of which is shown in Fig. 1.

The pots are cast with three bevelled "feet" by which they are grasped in the universal chucks of the machines. The bar *A* carries a boring cutter and the head *B*, the turning tool. The tool block *C* carries a nest of cutting-off tools so adjusted that the tool nearest the outer end of the casting is slightly in advance of the one succeeding it, the second slightly in advance of the third, and so on throughout the series. This tool slide is fed inward in one continuous movement, so that the cutting-off tools begin their work successively immediately after the boring and turning tools have passed the respective tool positions, so that all operations are going forward simultaneously and by the time the boring and turning is finished all but two or three of the rings are cut off and are hanging loose on the boring bar.

In the next operation, the edges of the rings are ground in a Heald piston-ring grinding machine, the width being slightly less than the nominal size so that a ring would be loose in its groove if used without the steel expanding ring.

The rings are next stacked in lots of 20 or more, according to their width, upon a shouldered mandrel where they are held by a collar and nut while being ground on the outer surface. It is at this point that the manufacture of these rings diverges from regular practice. Instead of being left larger than the cylinder in which a ring is to be used, it is ground to the exact size before the angular cut across its surface is made.

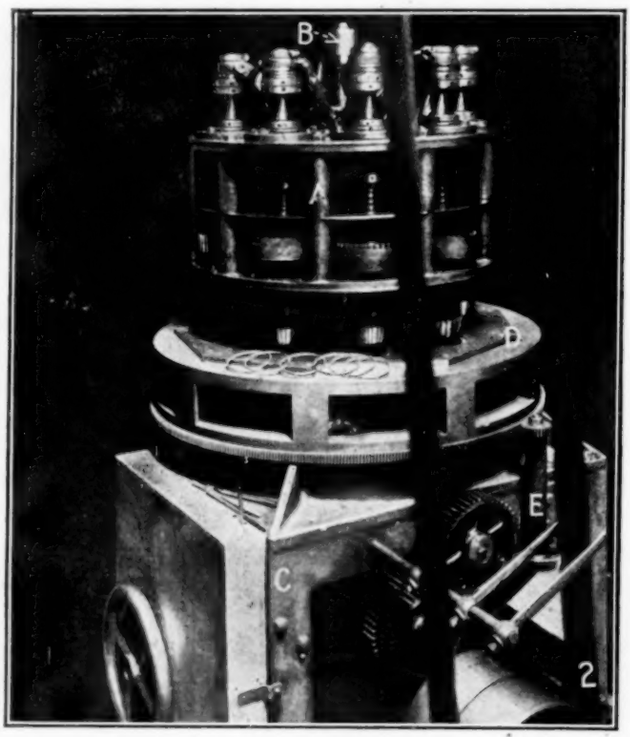


FIG. 2. COUNTERSINKING MACHINE—INDEXING POSITION

From the grinding operation the rings go to the specially designed machine shown in Figs. 2 and 3, which bevels or tapers the bore to 30 deg. included angle. This machine has six vertical spindles driven through the medium of a central gear which is mounted on a quill. The housing *A* in which the spindles have their bearings is stationary, and the spindles, besides revolving, have a vertical movement of about 3 in.; Figs 2 and 3 showing them in extreme positions. The vertical movement is accomplished through the medium of the levers which may be seen radiating from the center on top of the machine. The outer end of each lever is yoked to its respective spindle through a bronze thrust ring and the inner end is attached by a link to a collar on the central spindle *B*.

The spindle *B* does not rotate, but derives a vertical movement from a cam underneath the main frame *C* of the machine and extends through the center of the driving quill before mentioned. The cam is designed to give the machine spindles the same movement to and from the work as prevails in a turret machine; a rapid advance and recession with a slow forward movement during the time that the tools are cutting.

The turret *D* of this machine has nine chucks for holding the work, and has three positions. Thus, there are three chucks presented to the operator for unloading and reloading, three under the first three spindles for the roughing cut, and three under the second set where the rings are finished by a light cut.

One of the collets is shown in Fig. 4, and again in Fig. 5 where it is in place in the turret of the machine but with the protecting cover removed. The collets are of gray iron, but are otherwise the same as a recessed collet or, as sometimes called, a "step-chuck" in a screw machine. The central stud seen in Fig. 5 acts as a pilot for the cutter, one of which appears at Fig. 6. Inserted tooth cutters are used, the construction being plainly indicated in the illustration.

There is ample space at the bottom of each collet for the escape of chips, and pans are provided under each station to take care of them. The turret is turned 120 deg. at each movement by a train of gears, a part of which may be seen at *E*, Figs. 2 and 3. Opening and closing the collets is done by stationary cams under the machine so that all the operator has to do is to remove finished rings and place others to be bored. As the movement of the machine is continuous and progressive, the output is very satisfactory in point of time, while the results mechanically considered are quite equal to what could be produced by an individual operation in a lathe. The machine is shown with all guards removed.

The next operation is cutting the ring to allow for expansion. As the ring is already to size it is not necessary to remove a section as is done in the case of the snap ring, but it is cut with a single pass of a 16-gage slitting saw while mounted upon a suitable fixture in a hand milling machine. Fig. 7 shows the set-up, *A* being a stationary plate attached to the milling-machine table, tilted to the desired angle. *B* is a slotted clamp and *C* a handle, the forked end of which is formed to an eccentric shape. Adjustable stops in the plate locate the ring, the slotted clamp is slid into position over it, the lever depressed, and the work fed to the saw by the operating lever of the milling machine. All of the operations follow in rapid sequence.

The steel ring that supplies the necessary expansive force to keep the iron ring in working position is made from tempered-steel wire drawn to a trapezoidal section complementary to that of the outer ring and is received from the mills already tempered. It is delivered in large coils and a necessary preliminary operation is straightening to take out short bends.

A hand-operated coiling machine takes the wire from the large coils, passing the straightening rolls on the way, and delivers it in the form of a close-wound helix the diameter of which is exactly that necessary to make each individual ring fit inside its cast-iron mate. The coiling is done by means of rolls which are adjustable to any diameter of coil within the limits of the machine. These coils are run out to a length of about 10 in. and cut off.

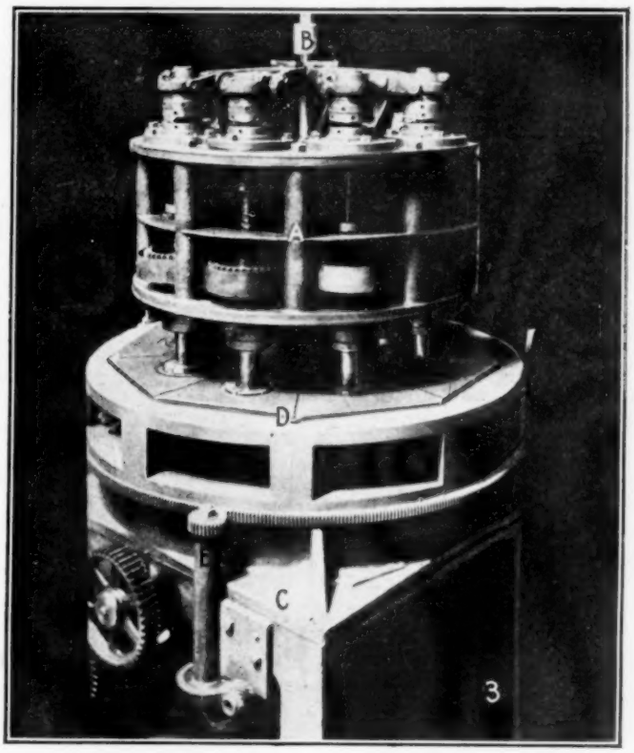


FIG. 3. COUNTERSINKING MACHINE—INDEXING POSITION

For cutting them into individual rings mandrels are provided having a slotted sleeve to cover the coil. As the latter is clamped lengthwise on the mandrel and the steel sleeve fits closely over the outside diameter, there is no chance for the rings to fly when the cut is made, even though there is a tendency for them to change their position. One of the covering sleeves is shown in Fig. 8 and the cutting operation in Fig. 9. Owing to the fact that the wire is already tempered, this is a somewhat slow and tedious operation, requiring a deal of care. The two hand clamps seen in the picture are put on as soon as the cut is started for the purpose of holding the sleeve against a tendency to open, due to the pressure of the cut rings.

After they are cut the mandrel is disassembled, the rings remaining in the sleeve, from which they are pushed out into baskets. There follows a manual operation in which they are opened by pulling them beyond their elastic resistance, leaving them with the ends apart about 1 in., while at the same time they are given a slight twist to bring the ends in line. When closed from this position they form true circles under considerable degree of tension. The rings are then ground upon the edges to a width slightly less than the width of the groove they are to fit.

The next operation is polishing the outer surface. As this surface is not parallel to the bore (and consequently not square with the ground edges) and further as the ring, being sprung open, is not round, this job is not so simple as would at first appear. It is quite necessary to maintain the bevel at a constant angle to keep the surface flat widthwise, and to avoid grinding hollow spots in the contour of the ring.

A machine designed especially for this operation by Mr. Saxon of the Yale Piston Ring Co. is shown in Fig. 10. The machine carries four polishing wheels, so that four operators may work upon it at once, each independently of the others. The wheel arbors stand at an angle of 45 deg. from the vertical and are driven through an adjustable friction - disk drive by which the polishing wheel may be driven at whatever speed may be desired to suit the nature and diameter of wheel used.

A circular table somewhat larger in diameter than the largest ring to be polished is provided for each wheel, the table being supported upon the upper end of a rod which, when the machine is in operation, is given a slowly reciprocating endwise movement in a direction parallel to the axis of the wheel, so that whatever work is held upon the table in contact with the wheel will be automatically passed back and forth across the face of the latter and thus avoid the tendency to wear grooves in its surface.

The reciprocating movement is accomplished by means of a peculiar shaped cam which is in effect the frustum of a cone the axis of rotation of which is parallel to its generating element. The cam is splined to a shaft which lies in a horizontal position directly under the end of the rod that supports the table. A roller in the end of this rod bears upon the surface of the cam, the endwise position of which on its shaft determines the magnitude of the reciprocating movement of the table from zero to a maximum of four in., thus accommodating any reasonable width of wheel-face. The camshaft is driven from the wheel spindle through worm-reduction gearing so that it revolves quite slowly.

Each operator may start and stop his wheel independently of the others by moving the lever which raises the driven friction disk out of contact with its driver. The driver may be moved endwise upon the central shaft to which it is held by a setscrew, and its position in relation to the driven disk determines the speed of the polishing wheel.

The central shaft runs continuously and as all four driver disks are setscrewed to it, it is obvious that ad-

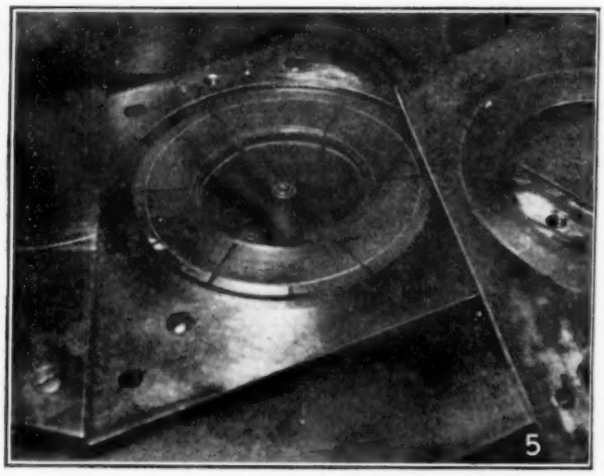


FIG. 5. A COLLET IN THE MACHINE

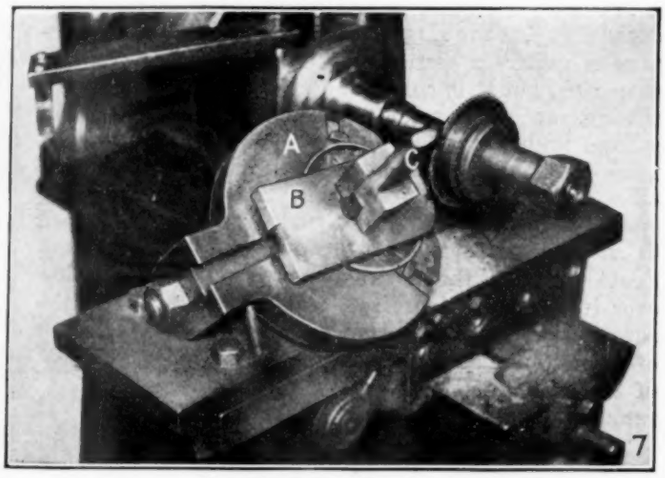


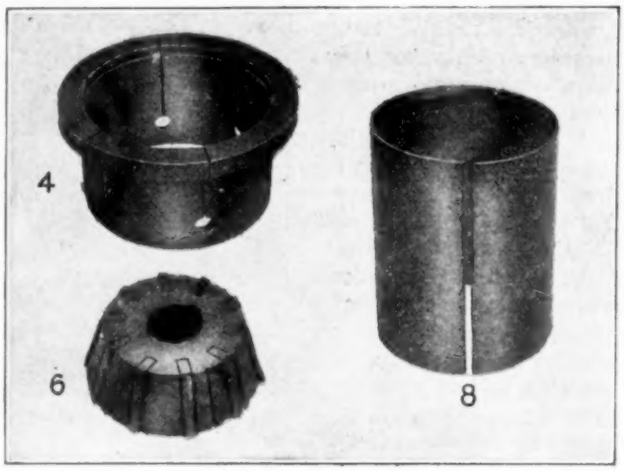
FIG. 7. CUTTING THE OUTSIDE RING

justment of speed for one wheel cannot be made without stopping the other three. In all other respects, however, each wheel is as independent as if it was an individual machine.

The work table is so mounted upon its supporting rod as to allow it to be tilted to whatever angle may be necessary to accommodate the beveled surface to be polished. A block or rest is fastened to the surface of the table against which the operator holds the ring to be polished, the surface of the ring lightly touching the wheel at another point. By reason of the frictional contact the ring has a tendency to revolve, and the operator allows it to float slowly under his fingers until it has made one complete revolution, at which time the polishing is usually complete.

As the ring is not round, owing to its having been sprung open to give it initial tension, it cannot be rigidly held to the wheel, and the operation is therefore somewhat dependent upon the skill of the operator to avoid grinding hollow spots on the periphery of the ring, but the men soon become experts and the work goes forward at a very satisfactory rate.

As has previously been noted both inner and outer rings are ground upon their edges to a width slightly less than that of the groove they are to occupy in the piston. When in position, the spring tension of the inner ring not only holds the outer one in contact with the cylinder walls, but by reason of the opposed bevels between them the rings tend to move edgewise in opposite directions, therefore each ring is pressed firmly against opposite walls of the groove in the piston, so that though each part be narrower than its groove the ring as a whole automatically fits the groove and the fit is maintained by the spring tension of the inner ring. A practically gas-tight joint is therefore formed between the edges of the ring and the walls of the groove, between the outer ring and the cylinder well,



FIGS. 4, 6 AND 8. SOME OF THE TOOLS USED
Fig. 4—One of the spring collets. Fig. 6—The beveling cutter. Fig. 8—A sleeve used in cutting the inside rings.

and between the surfaces of the outer and inner rings.

Though there is a joint in both inner and outer rings, care is taken in putting rings into the piston that the two joints do not coincide, so there is very little opportunity for gas to get past the piston.

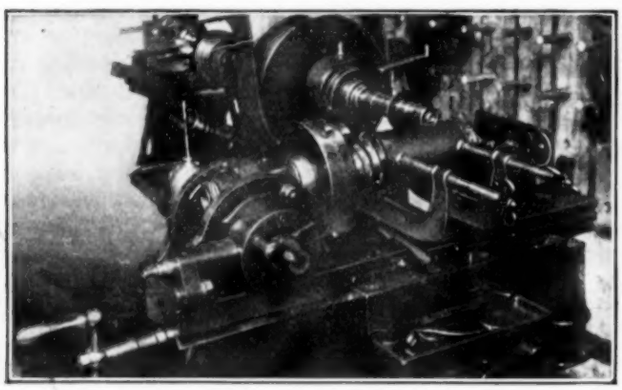


FIG. 9. CUTTING THE INSIDE RINGS

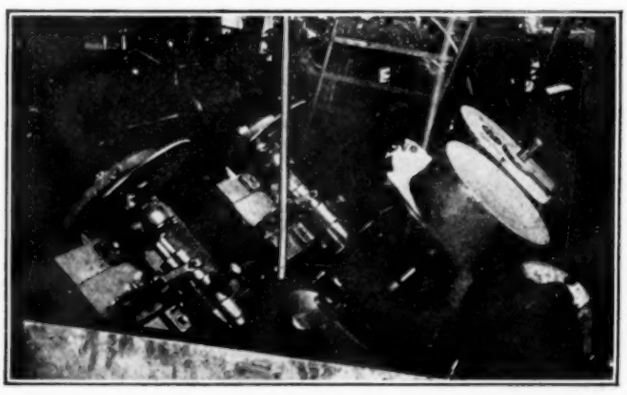


FIG. 10. THE RING-POLISHING MACHINE

THE PRODUCTION PLANNING SYSTEM *of the* HEALD MACHINE COMPANY

By W. S. Pratt, Production Engineer, Heald Machine Co.

I. General System and the Writing of Orders

It is one thing for a 500-man shop to plan for a certain production of machine tools to be manufactured six or eight months in advance and another thing to follow and finish the schedule as laid out. The author tells of a system that has enabled the production each month of almost exactly the number of machines planned for seven months in advance. This first installment will take up the general system and the method of writing the shop orders. A later article will tell of operating methods.

DURING the last few years there has been developed and put into operation at the plant of the Heald Machine Co., Worcester, Mass., a system for planning, scheduling, and routing the work that has enabled plans for the production of a certain number of machines six or eight months in advance to be made, and the plan as to completion dates on these machines to be followed almost exactly. A large number of shops plan their monthly production considerably in advance of the actual date at which the work is completed, but it is the author's belief that few shops are able to to produce at the date set as near to the number of machines planned for as is done in the Heald plant. These results have been accomplished by relieving the foremen and shop superintendent of all the responsibility of planning the work. This method allows the superintendent and foremen to devote all of their time to the execution of the work, to personnel and to shop discipline. A visit to the Heald plant, which is of about 500-man size, would convince anyone of the merits of the system as used.

THE HEALD MACHINE CO.

FROM MR. ELLINGHAM, WORKS MANAGER — DATE FEB. 1, 1919

TO MR. PRATT, PRODUCTION ENGINEER — ATTENTION OF — REPLYING TO YOURS OF

SUBJECT: PRODUCTION SCHEDULE OF MACHINES — IN YOUR REPLY REFER TO

FOR INTERNAL FACTORY CORRESPONDENCE ONLY USE SEPARATE SHEET FOR EACH SUBJECT OMIT ALL FORMALITIES

FEBRUARY

22 - 45100 -- 2
A - 39000 -- 12
K - 43200 -- 30
F - 36000 -- 15
J - 45200 -- 25
20 - 45700 -- 2
86

MARCH

K - 44200 -- 30
W - 45300 -- 10
W - 41000 -- 4
E - 45600 -- 25
80 - 48801 -- 1
70

APRIL

K - 44300 -- 30
F - 38400 -- 25
W - 28600 -- 15
70

MAY

K - 45500 -- 20
L - 43100 -- 25
F - 38600 -- 25
70

JUNE

K - 45900 -- 25
A - 45800 -- 25
E - 39800 -- 25
75

PURCHASING SCHEDULE

JULY

K - 46100 -- 25
L - 38300 -- 25
F - 38900 -- 30
80

AUGUST

K - 46200 -- 30
F - 39900 -- 30
22 - 48851 -- 25
85

FIG. 1. THE PRODUCTION SCHEDULE WRITTEN FEB. 1

Before going further with the description of the system, it would perhaps be advisable to outline the machines produced, the work done, and, in a brief form, the method of handling it. The product of the plant consists of 11 different types of grinding machines, nine styles of rectangular magnetic chucks, and 10 styles of rotary magnetic chucks. The unit method of con-

struction is used throughout the entire set of 11 grinding machines, a large number of the separate parts being common to two or more of the completed machines. After the parts are manufactured, the various complete units are assembled before being brought to the final assembly floor. The same method of procedure is followed with the manufacture of the magnetic chucks, thus allowing the same system to be used for both. In order to secure economy in manufacture and assembly it is advisable to push the parts through in lots of considerable size, and this is the method followed, the parts being manufactured and the machines assembled in lots varying up to 50 or even more if it is deemed advisable.

SCHEDULE OF

NO. OF MACHS. 30 — #70-71 75 & 76 INTERNAL GRINDING MACHINES — MACH. NOS. 2445 to 2475

DATE 7/1/18 — SWIVEL HEAD UNIT — ASSEMBLY NO. 43200

THREE SHEETS — SHEET #1 — K Unit #OB — PAGE

PART NUMBER	DR. SIZE	PART NAME	QUAN. REQ'D	ON HAND	MAKE	ORDER NUMBER	DATE STARTED	QUAN. FIN.	MATERIAL AND DIMENSIONS
K-299B	B	Swivel Head	1						Gray Iron Casting
		#6 Style "D" Bowen Oil Cups	2						
		5/16"-18 x 5/16" H'dls Set Screw U.S.S. Cup Pt. (Case Hardened)	2						
		5/16 x 3/4 Hex. Head Cap Screw U.S.S. (Soft)	4						
K-433B	B	Chuck Spindle	1						3-1/2" Diameter O.H 60 Pt M.S. x 16 – 9/16" long
		#21 Woodruff Key	1						
K-16	D	Head Spindle Bushing (Small)	1						#1 Wells Chemical BZ. Composition Casting
		1" x 1/4" Felt 1" long	1						
K-18	D	Head Spindle Bushing (Small)	1						#1 Wells Chemical BZ. Composition Casting
		1" x 1/4" Felt 1" long	1						
K-17	D	Bushing Adj. Block	4						3/4 x 1/4 Sq. Edge Screw Stock x 8-3/8" long (Stock makes 9 parts)
		5/16" x 7/8 Fil Head Cap (Case Hardened)	2						
		5/16 x 1 Fil Head Cap Screw U.S.S (Case Hardened	2						

FIG. 2. A SECTION OF THE DETAILED MACHINE SCHEDULE

The first step in the operation of the system is naturally the determination of the monthly schedule. This is done in a conference between the sales manager, the works manager, the production engineer, and the shop superintendent. It is the duty of the sales manager to study the market and decide what the demand for the various types of machines will be six or eight months in advance, but it can be seen that if he alone were empowered to write the monthly schedule it would be very easy for him to require a production that could not be met in the shop, and it is for this reason that the works manager, the production engineer, and the shop superintendent are called into the conference. They, of course, know the condition of the work in the shop and are thus able to correctly advise the sales manager as to the possible deliveries of types of machines that the trade is calling for. After the decision has been made as to what machines will be produced, the works manager writes out the schedule and turns it over to the production engineer.

It might be well to state at this time that each lot or assembly of machines, regardless of the quantity to be produced, is given an assembly number which, for convenience sake only, consists of five figures; for example 43200. This assembly number means to all whom it concerns the date of the delivery only and has no other significance whatsoever. Throughout the system particular pains are taken to see that all information possible is given to the shop in regard to the work, not only the correct details of machining but also information pointing to the time that each part will be required on the assembly floor.

A copy of the production schedule issued Feb. 1, 1919, is shown in Fig. 1, this being made up on an 8½ x 11-in. sheet. From this illustration it will be seen that the schedules are written up for seven months' work in advance. Work for the first five months can be placed in the shop for machining at the discretion of the pro-

PART NAME IDLER PULLEY CAP PART NO. K-147A

NUMBER PARTS USED ON MACHINES												NUMBER SHIPPED ON SHIPPING ORDERS	NUMBER OF PARTS ON HAND	DATE
A	E	F	J	K	L	R	W	20	22	60				
												385	75	2/1/19
1	1			1	1		1					Year 1918		

ASSEMBLY	K-43200	W-45300	W-41000	K-44200
REQUIREMENTS	60	-20	8	60
ORDERS WRITTEN	✓	30	✓	150
	15	25	17	107
Shrinkage-1-2/1/19		24	16	106
Defective-5-2/1/19		19	11	101
ASSEMBLY	F-38400	W-45300	K-44300	A-45800
REQUIREMENTS	50	30	50	50
ORDERS WRITTEN		✓	✓	✓

FIG. 3. DETAILED REPORT OF PARTS IN PROCESS

duction engineer, but he is not allowed to work on any of the materials that might have been received under the purchasing schedule, in this particular case for July and August. The purchasing agent in turn is allowed to work only on the schedule for these two months and must have had all material for the previous month, in this case June, purchased at the time the schedule was written. Under the heading "February," it will be seen that 2 type-22 machines are to be built on assembly order 45000; 12 type-A machines on assembly order 39000; 30 type-K machines on assembly order 43200; 15 type-F machines on assembly order 36000; 25 type-J machines on assembly order 45200; and 2 type-20 machines on assembly order 45700, making a total of 86 machines to be produced for the month of February. In a similar manner the number of each type machine to be produced in the months of March, April, May, June, July and August can be determined.

Similar schedules are drawn up for the production of chucks and wheel heads. The only difference on the chuck schedule is that the purchasing agent is given three months in which to secure the required material, while the time in which the production engineer must pass the work through the various machining and assembling processes is reduced to four months. The wheel-head schedule is made up on a weekly instead of a monthly basis. This is possible because the number of operations involved in the manufacture of a wheel head is far less than that required in the manufacture of a complete machine.

Upon completion of each month's work a conference is held between the sales manager, the works manager, the production engineer and the shop superintendent, and work for another month is added to the schedule, the shop and purchasing schedules each being moved ahead one month. This method of procedure always keeps five months' work ahead in the shop and two months ahead for the purchasing agent. The reason for limiting the production department to five months' work in process is to maintain a balance in the shop, as it would be easy, if the production department were allowed to use any work available, to soon unbalance the shop, having parts completed that were not needed for a long time, while many of the parts required would not be finished. The production department is not allowed to call for any of the raw material beyond the five months' schedule, but the purchasing agent must see that all of the raw material for this five months' schedule is in the shop and available for the use of the production engineer.

When delivered to the production engineer, the production schedule acts as an order for him to put the machines called for into production, and the next step is a request on the drafting department by the production department for a detailed machine schedule for each type of machine called for in that particular month that was not on the schedule for the preceding month. For example, looking at the schedule in Fig. 1, the only detailed machine schedules called for by the production engineer upon receipt of this schedule would be those for types K, F and 22 machines in the month of August, those for July having been called for the previous month. Fig. 2 is a reproduction of one sheet of the detailed machine schedule for a K machine. This detailed machine schedule, made upon sheets measuring 12 in. wide by 14 in. high, contains a list and detailed information of all parts required in the assembling of the machine, giving the part number, drawing size and part name, together with information in regard to the material and dimensions, the quantity required for each unit assembled, blank columns being left in which may be inserted the number on hand, the number to be made, the order number, the date started and the quantity finished. As these detailed machine schedules are furnished by the drafting department for each assembly of machines, it gives a chance to check over the sheets and incorporate any changes as fast as they are made. Together with other information at the head of the schedule sheet is the notice that the particular parts called for on this sheet are used on four different types of machines; namely, the Nos. 70, 71, 75 and 76. It also states that these parts go to make up the swivel-head unit (K Unit No. 9 B), and that three sheets complete the list of parts for this unit. A complete detailed machine schedule consists of a considerable number of sheets similar to the one shown and contains information in regard to every different part that is required to complete a finished machine.

After the detailed machine schedule is received by

Form 67-10-18-8000 Quad. **THE HEALD MACHINE CO.**

Date Mar. 1, 1919. *Part No.* K-209B

Acct. No. 4202 *Jig No.*

Assembly No. 43200 **№ 51681** *Tool No.*

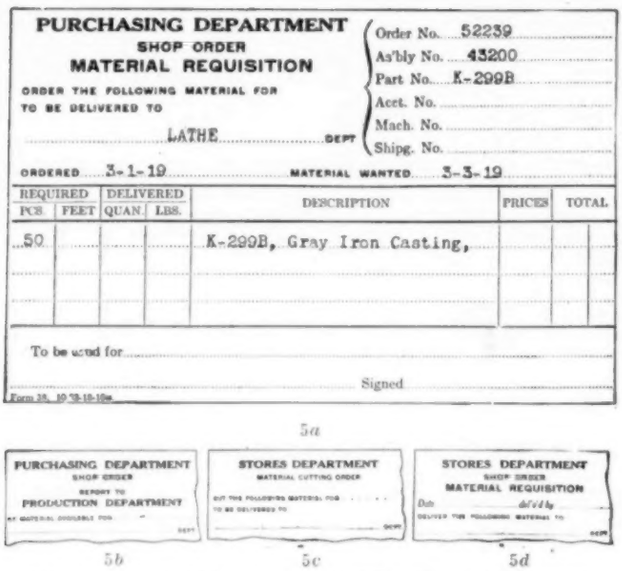
Quantity 50 *Shipping No.*

Please make Swivel Head

Pieces Finished *Signed*

Store Dept. Return this order to Cost Dept. immediately on receipt of finished parts.

FIG. 4. THE SHOP ORDER



PURCHASING DEPARTMENT
SHOP ORDER
MATERIAL REQUISITION

ORDER THE FOLLOWING MATERIAL FOR
TO BE DELIVERED TO
LATHE DEPT

Order No. 52239
As'bly No. 43200
Part No. K-299B
Acct. No.
Mach. No.
Shipg. No.

ORDERED 3-1-19 MATERIAL WANTED 3-3-19

REQUIRED PCS.	REQUIRED FEET	DELIVERED QUAN.	DELIVERED LBS.	DESCRIPTION	PRICES	TOTAL	
50				K-299B, Gray Iron Casting,			

To be used for
Signed
Form 28, 10-19-18-10M

5a

PURCHASING DEPARTMENT
SHOP ORDER
REPORT TO
PRODUCTION DEPARTMENT
DEPT

STORES DEPARTMENT
MATERIAL CUTTING ORDER
DEPT

STORES DEPARTMENT
SHOP ORDER
MATERIAL REQUISITION
DEPT

5b 5c 5d

FIG. 5. THE RAW-STORES MATERIAL REQUISITIONS

the production department it is sent to the stores department with a request that the stores department fill out the "On Hand" column, and when returned to the production department with this work completed, it shows the number of each different part required for this particular type of machine that is in stock. As this work is some six or eight months in advance of assembly the report of the finished parts in stores is the starting point which, taken together with the orders already written on previous schedules, determines the necessity of making up an order on the schedule being written at this time. It is not customary to make up each individual part on the assembly for which it is going to be used, for, as previously stated, there are many parts such as those made on automatic machines which it is necessary to make up in quantity, sometimes as high as 1000. A quantity of this size will, of course, carry over for a number of different assemblies.

Parts in Process

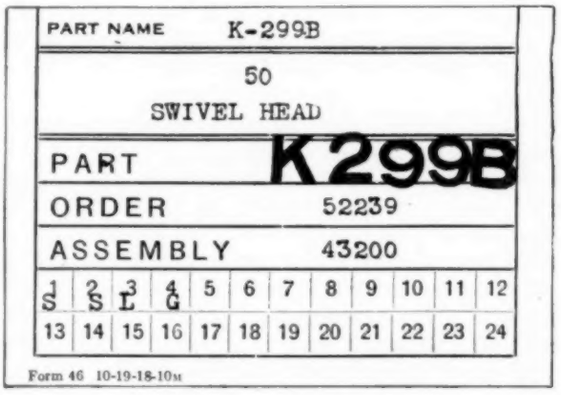
In order to keep before the production engineer at all times a detailed report of the parts in process in the order in which they will be called for, the form shown in Fig. 3 is used. This form gives the part name, part number, and, as some of the parts may be used on other machines, also shows the machines on which the particular part is used and the number of parts necessary for each machine. Below the heading on the sheet are spaces for the assemblies in the order in which they are scheduled, the requirements on each assembly, the quantity of the orders written on each assembly, and below, in the narrow spaces, are filled in the quantities that will be in the stock room after the assemblies have been completed. The figure in the first narrow space shows the surplus left at the time of writing after deducting the requirement for that assembly, provided that no shrinkages occur. In the narrow spaces below are noted each day any shrinkages, and these are deducted from the surplus. It will thus be seen that the figure in the lowest narrow space filled out is the correct surplus at any time.

For example, on the sheet shown, which calls for idler pulley cap, part No. K-147 A, it will be seen that one each of these parts is required on machines A, E, K, L and W, and that the number of parts on hand on Feb. 1, 1919, was 75. On the writing of schedule K-43200, 60 parts were required which, taken from the 75 already on hand, left a surplus of 15, shown in the narrow space below. Schedule W-45300 was written, requiring 20 parts, and as the surplus of 15 was not enough to cover this requirement an order was written for 30 more, leaving a surplus of 25.

The next schedule written, W-41000, called for eight parts, and as the surplus on hand was 25, it was not necessary to write any order for this part. The next schedule, K-44200, called for 60 machines, and as the surplus on hand was only 17, it was decided to put 150 in production, and orders were written to cover this amount. Going back to assembly K-43200, it will be noted that on Feb. 1 there was a shrinkage of one, reducing the surplus to 14 and also reducing the surplus quantities under each of the other three assembly numbers by one. On Feb. 3, five defective parts were found, reducing the surplus under assembly K-43200 to nine, under assembly W-45300 to 19, etc., down through the list.

If at any time the surplus in the finished-stores department should fall below the quantity required on a given assembly number, it is possible to either move ahead the parts required on the following assembly, or to write another order to cover the deficiency. It has generally been found better to move the parts on a future assembly ahead than to write a new order, as in all probability the raw material for the parts for a future assembly is in stock and ready to be worked upon, while if a new order were written, time has to be given to the purchasing agent to secure the material.

Returning now to the detailed machine schedule, Fig. 2; after this has been returned from the stores department with the column "On Hand" filled in with the surplus of each part in finished stores at that time, the production engineer takes the book of sheets showing the parts in process, Fig. 3, and runs through the detailed machine schedule, deciding whether or not, in view of the surplus parts on hand and the parts in process, it is necessary to put any more into production. If so, the number required is marked in the column "Make" and if not it is checked as O. K. When an O. K. is placed in this column it indicates that *at the time of assembling* this particular lot of machines, enough parts will be on hand to take care of the assembly. After the complete detailed machine schedule has been filled out in this manner it is turned over to a stenographer for making up the necessary details for the completion of the work.



PART NAME K-299B

50
SWIVEL HEAD

PART K299B
ORDER 52239
ASSEMBLY 43200

1 S	2 S	3 L	4 G	5	6	7	8	9	10	11	12
13	14	15	16	17	18	19	20	21	22	23	24

Form 46 10-19-18-10M

FIG. 6. THE CARD USED ON THE PLANNING BOARD

The first step is the writing of the shop orders for the individual parts that the detailed machine schedule indicates must be made up. One of these shop orders is shown in Fig. 4. An order of this kind is made out for each different kind of the part that the schedule indicates it is necessary to make up. These order

FORM 106

Keep Envelope and Contents With Work.

PART	K-299B
ORDER	52239
ASSEMBLY	43200—Acct./#202
DRAWING	B-K-299B
ARTICLE	Swivel Head
MATERIAL	K-299B, Gray Iron Casting
ROUGH DIMENSIONS	
REQUIRED	50
DELIVERED	
DEFECTIVE STOCK	
FINISHED	
INSPECTED BY	
MATERIAL AVAILABLE	
ACCEPTED BY	

FIG. 7. THE TRAVELER ENVELOPE

blanks are made up in pad form in quadruplicate, the sheets being colored white, pink, yellow and green. The white and green copies are filed in the production department. The white, being filed under the part number, forms a ready reference to determine how many parts are in the process of manufacture. The green copy is filed under the order number to serve as a cross index. The pink and yellow copies go to the cost department. All costs are figured on the order numbers, and for this reason the pads, when made up, have the order numbers printed on so that there shall be no possibility of duplication. It will be noticed that the order contains the date, account number, assembly number, quantity desired, the name of the part, part number, jig number, tool number and shipping number, and is a request upon the shop to make a stated quantity of parts. After these orders have been written, the order number is filled in on the detailed machine schedule under the proper heading, Fig. 2. The next step is the writing of the raw-stores material requisitions shown in Fig. 5. These forms, like the shop orders, contain the part number, order number, and assembly number, and state the number of pieces required. They also give the raw material to be used with the dimensions and other information taken from the last column of the detailed machine schedule, Fig. 2, under the heading "Material and Dimensions." The form, Fig. 5, is made up in pads, the sheets being in quadruplicate, green, brown, yellow and blue, the only difference being in the headings. The complete sheet is shown in Fig. 5a, while Figs. 5b, 5c and 5d are small sections showing the changes of the heading on the different sheets. The green and brown copies, Figs. 5a and 5b, are sent to the purchasing department, the green copy serving as an order on the purchasing department to purchase the raw material indicated. The brown copy is kept by the purchasing department until the raw material described has been received in the shop, and at this time it is sent back to the production department, serving as a report to that department that the material is in the shop and available for use. The blue copy, Fig. 5d, remains in the traveler, which will shortly be described, and upon presentation to the stores department serves as an order to the stores department to deliver the desired material to the department noted. This is accepted as a receipt and passes through the stores department for the proper checking of material. The yellow copy, Fig. 5c, remains in the traveler until the stock is reported available, when it is sent to the cutting-off room as an order to cut the stock to size. This method allows the stock to be cut in advance of the time that it will be required by the shop. This yellow copy is not used unless it is necessary to cut the raw stock.

It will thus be seen that at one writing four sheets are produced—one ordering the purchase of the material, the second to be used as a report that the raw material has been received, the third an order to the cutting-off room to cut the raw stock to the required dimensions, and the fourth upon presentation being an order on the stores department to put the raw material at the disposal of the machine shop.

Planning-Board Card

At this time the card shown in Fig. 6, which is used on the planning board, is also made out. One of these cards is made out for each different part

ARTICLE — PART L-19B

QUANTITY OF ORDER 100 ORDER NO. 52131. SERIAL L-3-1-19

MATERIAL AVAILABLE ASSEMBLY 43200

MATERIAL DELIVERED SHEET WITH COMMENCE AFTER ORDER

INS'D	INSTRUCTIONS	PREM.	MACH.	Tool or Jig No.	TOOLING	SEC.	BIN.
	1 SNAGGING DEPT H Clean thoroughly, removing fins, sprues and sand.				Tools kept in Dept.		
	2. LATHE DEPT. A Gisholt Turret Lathes 838,7c4.	.40		Jig 1292	holding fixture with:-		
	Hold in chuck by small step.			1292-3 Tools	centering plate.		
	Chamfer edge of hole (to prevent reamer from cutting scale.)			4567	NOT WITH JIG:- roughing boring head.		
	Drill, bore & ream hole to size			4567-1	finishing boring head.		
	(Use drill 3862; boring bar & reamer 4260.)			4567-9	roughing tool holder.		
	Rough turn web face (use tool 4567-9.)			4567-3 4567-4 4567-5	roughing cutters		
	continued						

FIG. 8. ONE OF THE ROUTE SHEETS

Form 35A. 5-7-15-10M. **STORES DEPARTMENT REQUISITION**

Storekeeper: *Please deliver to*

Mr. Assembly Dept. No.

THE FOLLOWING MATERIAL AND CHARGE SAME TO

Date Mar. 1 1919 *del'd by*

Order No. 51670
As'bly No. 43200
Part No. K Unit 9B
Acct. No.
Mach. No.
Ship'g No.

REQ'D	DELIVERED QUAN.	DELIVERED LBS	DESCRIPTION	PRICE	TOTAL
50			K-299B, Fin.		

To be used for

Signed

FIG. 9. THE STORES DEPARTMENT REQUISITION FOR ASSEMBLY

ordered and contains the part name, part number, the number required, the order number, assembly number, and has at the bottom a series of numbers running from 1 to 24 that are used to indicate the order of the operations through which the part must pass before being completed. Under each number, or, rather, under as many numbers as there are operations on the piece, is put an initial indicating the department in which the operation of that number is to be handled.

In the illustration it will be noticed that the letters S, S, L and G appear under the numbers 1, 2, 3 and 4 respectively, this indicating that four operations are required to complete the piece. After being made out, the cards are filed according to their assembly number and under this number are filed alphabetically according to the department in which the first operation on the part is to be performed. The use of this card will be explained later.

The Traveler Envelope

The next step is to make out the traveler envelope, shown in Fig. 7. This is an envelope of heavy brown paper, measuring 5½ x 7½ in. This envelope shows on its face the part, order number, assembly number, drawing number, the name of the article, material required, the number of parts required, and a number of other items.

It is now necessary to call upon the drafting department for a detail blueprint of each of the parts to be made up and duplicate route sheets for use in the shop and in the production department.

The route sheets are 8 in. wide and 5 in. high, for convenience in handling, as many being used as necessary. A sample sheet is shown in Fig. 8. The drawings and route sheets are used for one lot of machines only, and whenever an order is written for a new lot, a new set of drawings and route sheets is furnished, this being a positive check that no old or obsolete drawings or route sheets can be furnished the operator and the work incorrectly machined. The use of new drawings and route sheets, both of which are blueprints, for each assembly might seem like useless expense, but the excuse "well we made it like the print" is seldom heard when a piece of work is machined incorrectly, for there are no obsolete prints around the shop that can be picked up by mistake. A more complete description of the route sheets will be given later, and for the present it is enough to state that the duplicate route sheets are made for each part to be made up, one copy being kept in the production department and the other attached to the drawing for that part, and placed in the traveler which remains with the work from the time it is delivered to the machine shop from the rough-stores department until it is received in the finished-stores department after final inspection. The travelers are filed in the production department from the time they are written until the material is ordered from the rough-stores department to the shop, but this will be explained more in detail later. The sets of route sheets in the production department are filed in loose-leaf notebooks. This sheet will be described in more detail later.

Orders for Assembling

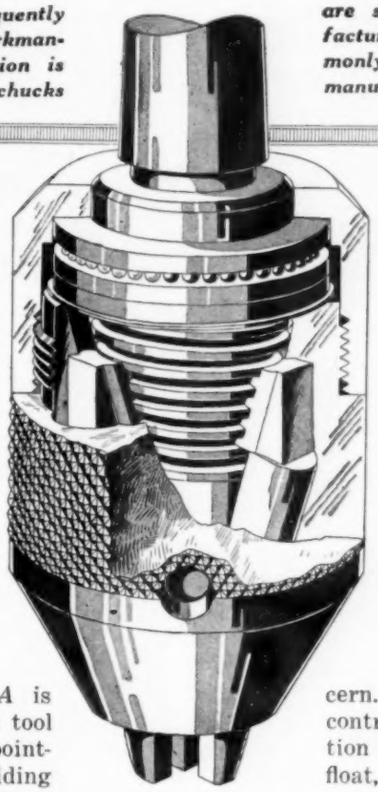
It now becomes necessary to write orders on the shop for the assembly of each different type of unit assembly. The forms used are the same as those shown in Fig. 4, are made out in quadruplicate, and contain, as previously described, the part number, order number, assembly number, quantity required and each set forms a request on the shop to assemble a certain number of the desired unit. An assembly traveler, similar to the traveler already described, is also made out and contains an assembly drawing and a route sheet similar to those already described. The traveler also contains a stores-department requisition for each part used which is a request on the storekeeper to deliver to the assembly floor the finished parts necessary for the assembly. One of these requisitions is shown in Fig. 9. These sheets are made up in pad form in duplicate, pink and blue, and in the case of a commercial article that is purchased in a finished state, the pink copy goes to the purchasing agent to show him the rate at which the supply of these parts is being used up. In the case of an article manufactured in the shop, however, only the blue copy is used, this being placed in the traveler and serving, at the time the traveler is sent into the shop, as an order on the storekeeper to deliver to the shop the various parts required on the assembly.

After this detail work has been completed, the finished travelers with their contents are filed in a cabinet marked "Held for Stock," under the assembly number on which they are written. As fast as the stock necessary is reported available by the purchasing department on the brown sheets already described and shown in Fig. 5, the travelers are transferred to a similar file marked "Work Available for the Shop," where they are kept until it is decided to start the work through the shop. The travelers are filed under the assembly number on which they are written, and under this number are filed alphabetically according to the name of the department in which the first operation on the part in question is to be performed. This method of filing allows a very easy survey to be made of the material ready for the shop and available for each department. As previously stated, production-office control is exercised on all work in process, the foreman being relieved of all responsibility as to the routing and planning of the work, this power being vested in the production engineer. The production engineer has, of course, a more general knowledge of the whole situation than any one foreman, and for this reason is better able to judge as to the dates on which the various parts should be finished and can thus maintain a better balance for the whole shop. This system does, however, require the use of something that will tell the production engineer at a glance where any job in the shop is located and, for this purpose, a planning board which will be described in the next installment of this article is used.

Manufacturing the ETTCO DRILL CHUCK

Editorial Correspondence

The drill chuck is the most frequently used tool in the shop. The workmanship entering into its construction is usually of the best. However as chucks are specialties, the method of manufacture, while not secret, is not commonly known. This article covers the manufacture of a well-known chuck.



THE drill chuck shown in the headpiece has recently been developed by the Eastern Tube and Tool Co., Brooklyn, N. Y. The jaws are advanced or withdrawn by means of a threaded male cone. The thread on the cone is comparatively coarse, being 7 per in. The chuck consists of five components, the body, cone screw, jaws, cap and ball thrust bearing.

The body is made from bar stock on a Cleveland automatic. In the set-up in the automatic the body is taper-bored on the inside, the outside is roughed for the threaded portion, the nose is tapered and the work cut off.

The second operation is performed on a hand screw machine with the set-up shown in Fig. 1. The body *A* is gripped in a two-jaw chuck. The first tool presented to the work is the single pointed boring tool *B* mounted in the sliding holder *C*. When the tool *B* is in operating position, the follower *D* is in contact with the 30 deg. hardened former strip *E*. By means of a suitable spring within *C* the follower *D* is kept in contact with E, but as the turret is advanced the pressure of the spring is overcome and the tool forced to follow the angle of the former. The threaded end is now turned concentric with the finished tapered hole and the thread cut.

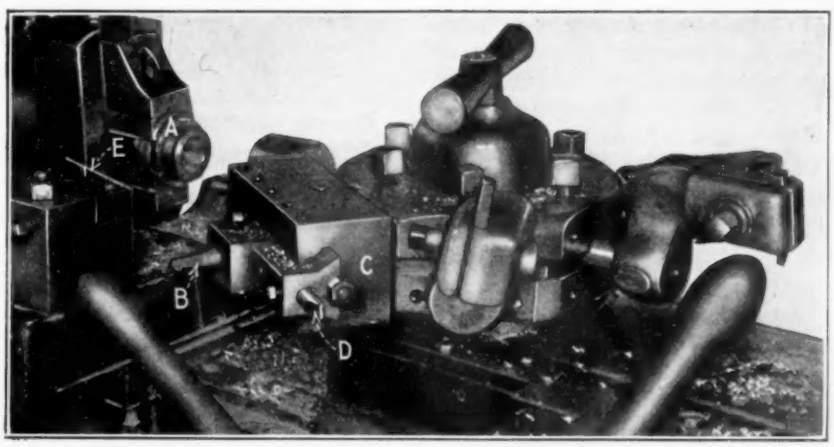


FIG. 1. SECOND OPERATION ON BODY

After removal from the chuck the tapered hole is hand reamed and tested for accuracy. This reaming operation might perhaps more correctly be termed "scraping" as the boring tool leaves very little metal to be removed. For all subsequent operations on the body the tapered hole is used as the locating point.

The next series of operations is also performed on a hand screw machine, as shown in Fig. 2. The body *A* is located on a tapered plug in the 15 deg. angular indexing fixture *B* so that the jaw holes can be finished. The hole is first drilled with the twist drill *C*, which is followed by the single pointed boring tool *D* and finally reamed to finished size with the reamer *E*. For all heavy drilling the Ettco chuck is used to hold the drill. It might not be out of place here to state that the writer saw a $\frac{17}{32}$ in. size Ettco chuck drive a counterbore about $1\frac{1}{4}$ in. diameter. Mr. Emrick, the inventor of the chuck, states that he turned down the shank of a 1 in. U. S. S. tap to fit the chuck and with it he tapped a full thread in cast iron.

The reamer *E* is held in a Quicktite chuck manufactured by this same concern. The jaws of this type of chuck are controlled by a three-lobed cam whose action is such as to permit a slight amount of float, so that the reamer centers itself in the bored hole and follows it accurately, no floating adapter being necessary.

The center hole for the passage of the drill and the side holes for the tightening rod are now drilled. It may be mentioned here that only for heavy duty is anything but the hand necessary for tightening the chuck. The hand also usually suffices for releasing but the action of the jaws is such that the greater the twisting stress in drilling the tighter they grip. It therefore is sometimes necessary to use a bar to open the chuck to release the drill after heavy work.

By referring to the headpiece it will be noted that the thread on the jaws is cut on a head which projects inwardly beyond the cylindrical part of the jaw. The next operation on the body is to drill the seats for these heads. This is done in the drilling fixture shown in

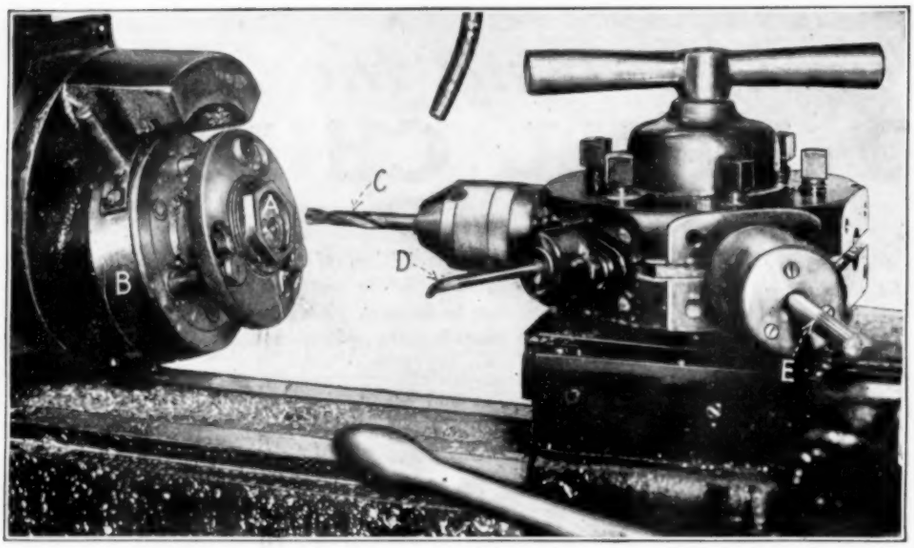


FIG. 2. DRILLING, BORING AND REAMING THE JAW HOLES

Fig. 3. The fixture is tilted to the angle of the jaws. A conical stem underneath *A* provides a seat for the chuck body *B* which is clamped solidly by means of the lever *C*. Three guide bushings *D* fit in the openings in *A*. One of them is shown in operating position in *A* while the two which are removed show their shape and their position in the chuck body. The stem *F* enters the hole already reamed in the body *B*. A groove *G* down the side of *F* guides the drill which is drilling a little less than half a hole. The stem in the fixture on which the body is mounted is also grooved. The drill is thus held between two grooved members of hardened steel which prevent it running out. In operation the upper part of the fixture is indexed from hole to hole. This finishes the body of the chuck.

As drill-chuck jaws are subjected to excessive use and abuse, it is therefore necessary that they be made of high grade stock which is not only very hard but very tough. The jaws for these chucks are made of chrome nickel steel, pack hardened and heat treated.

The stock is cut off to length in the screw machine, after which it goes to the heat treating department. The body is ground to size on a cylindrical grinder which is an ordinary job requiring no description. Two flats are next cut on the rear end as shown in Fig. 4, this being a simple straddle milling operation. The blank is shown at *A* and the completed work at *B*. In the next operation the work from the previous operation is set up as shown in Fig. 5 in a gang milling fixture, and with three cutters the jaws are milled to length and the back angle on the rear end of the jaw is milled. The two outside cutters trim the work to length while the inner one mills the angle. The work from the previous operation is shown at *A* and after this operation at *B*. The gripping end of the jaw is now milled off at an angle with the two cutters

FIG. 3. FIXTURE FOR DRILLING THE KEYWAYS

shown in Fig. 6. The vise *A* is provided wih shaped jaws to locate the work properly. At *B* are shown several chuck jaws from the previous operation and at *C* a jaw with the grip milled.

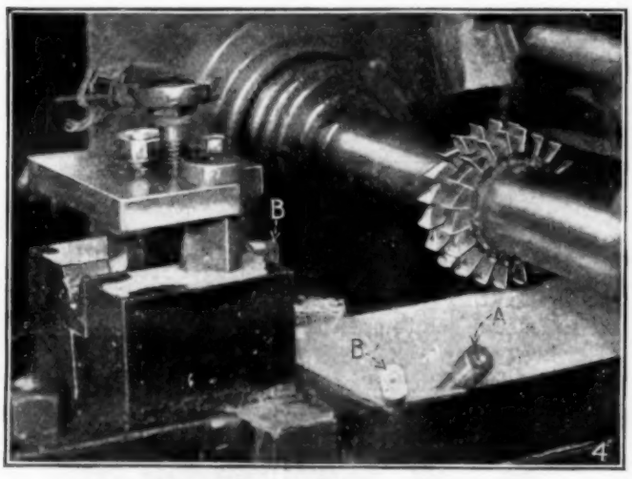


FIG. 4. MILLING FLATS ON REAR ENDS OF JAWS

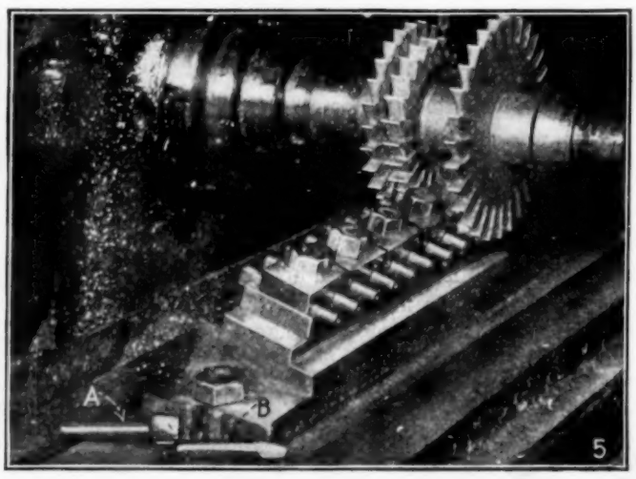


FIG. 5. MILLING TO LENGTH AND BACK ANGLE

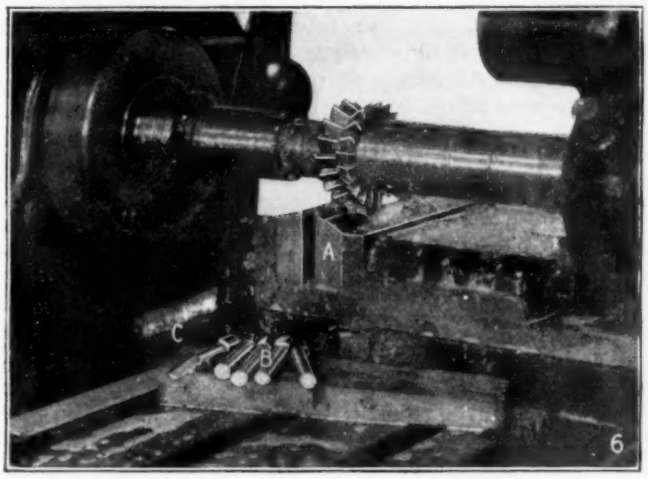


FIG. 6. MILLING THE GRIP

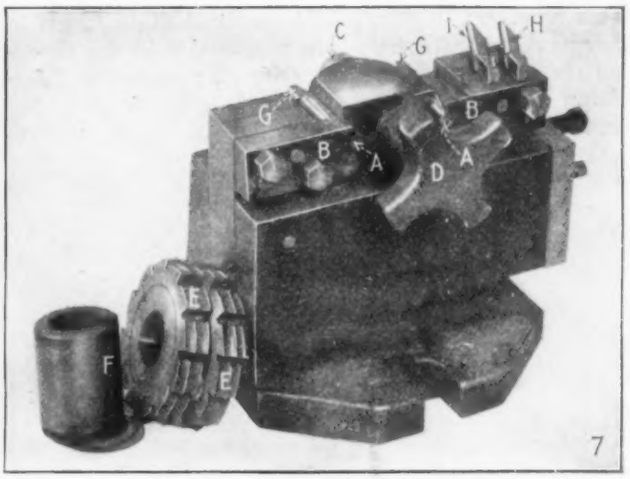


FIG. 7. MILLING THE KEY ON THE JAWS

The next step is milling the key. This is done on the fixture shown in Fig. 7. The grips of two jaws *A* are forced to a seat in the two stationary V-blocks *B* in the fixture. This is accomplished by the clamp *C* operated by the knob *D*. The cutters *E* are spaced by the washer *F* and mill the form on the jaws at *G*.

Milling the Thread the Final Operation

Work from the previous operation is shown at *H* and at completion of this operation at *I*. The final machining operation on the jaws is milling the thread. Owing to the jaws being actuated by a conical screw there were many difficulties to be overcome. The thread is 7 pitch but at the base the cone is approximately 1¼ in. diam. The diameter decreases to about ⅝ in. in 1¼ in. of length. This means that the helix angle increases from the base towards the apex. Several methods, including hobbing with a conical hob, were tried for cutting the threads on the jaws, all of which were abandoned, because of objectionable features, in favor of the present method.

This is a simple milling fixture with means for clamping 12 jaws at a time, six on each side of the fixture.

The axes of the jaws are disposed at an angle of 92½ deg. to the travel of the table which gives the mean helix angle. The cutters are disposed on each side of the fixture and cut 4 full threads in each jaw. The thread on the cone is milled on the special machine shown in Fig. 8. The cone blank *A* is mounted on a tapered plug in the spindle *B*. This spindle is disposed at an angle of 15 deg. from the center line of the cutter spindle *C*. The worm wheel *D* drives the 7 pitch lead screw *E*, the forward end of which is geared by even bevels *F* to the spindle *B*. The worm can be disengaged and the work and carriage *G* returned to starting position by the hand wheel *H* which is secured to the lead screw.

The lead screw *E* is of cast iron, working in a two-piece bronze nut to permit adjustment for wear. Owing to cutter interference it was found necessary to make the thread angle 30 instead of 29 deg. The thread is perpendicular to the angle and not to the axis of the work. This gives it the appearance of a buttress thread. Adjustment of the cutter to depth is made by means of the slide on the cutter head *I*.

The cap is finished, with the exception of the thread, at a single setting in the automatic screw machine.

The second operation, that of threading, is done in a hand screw machine. The method of chucking the

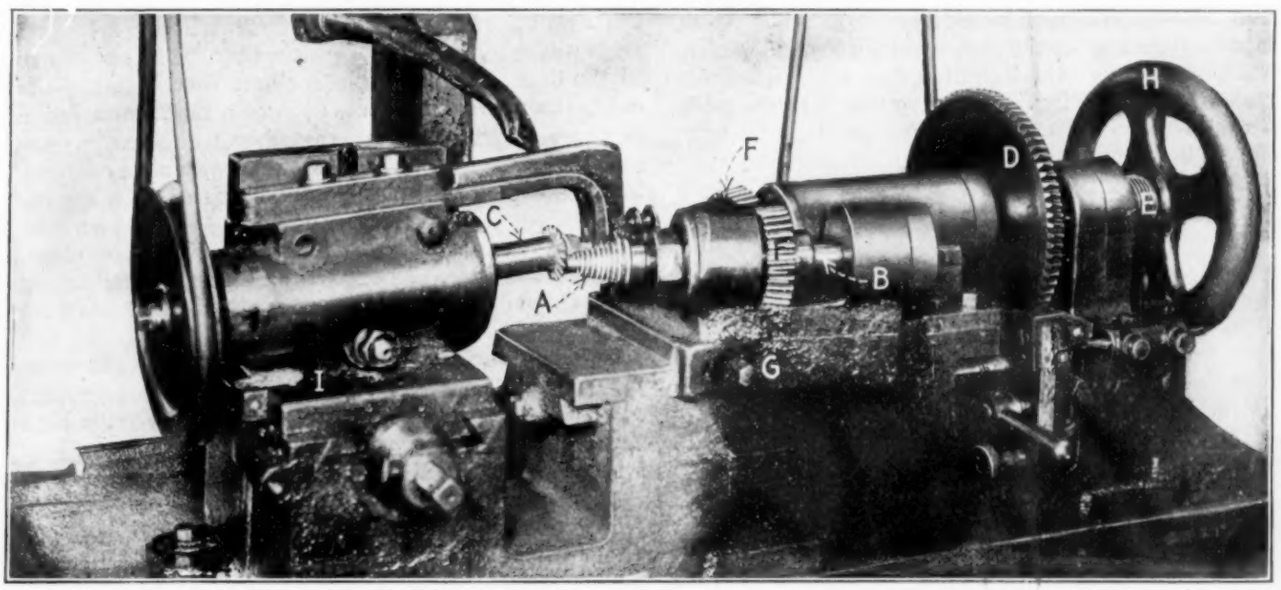


FIG. 8. THE CONE SCREW MILLING MACHINE

made as shown in Fig. 9. The work *A* fits a recess in the chuck body *B*. Two swing bolts *C* hold the clamping ring *D*. Inside the clamping ring *D* is a compensating ring *E* hung on trunnions *F*. In this way the thin shell *A* is clamped end-wise and if one of the bolts

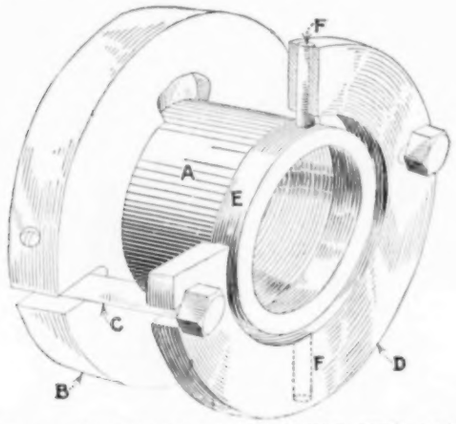


FIG. 9. CHUCK FOR THREADING THE CAP

C is tightened more than the other the compensating ring pivots on the trunnions and distributes the load equally on both bolts and evenly on the work. After assembling, the outside is knurled for a grip. This also binds the cap securely to the body. The chucks now go to the final operation, *i.e.*, grinding the grip on the jaws. This step is shown in Fig. 10. Three dogs *A* are

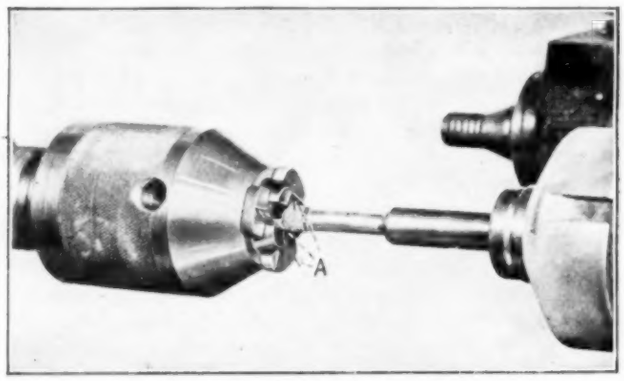


FIG. 10. GRINDING THE GRIP

placed between the jaws which are tightened on them. The gripping edges of the jaws are then ground concentric. The hand alone will tighten the chuck sufficiently for all ordinary drilling. For severe duty a short bar in the radial holes will close the chuck so tight that the drill will break before it slips.

Dies for Drawing Brass Tubing

BY E. A. DIXIE

There are several things in the article on the above subject which was printed on page 1150, Vol. 50, which I would like to have cleared up.

Are we to assume that the dimension *E*, Fig. 2, is the *radius* of what is shown as a sharp corner in the illustration? If it is, then, according to the table below the cut, the radius *E* is the same for dies from 0 to 3 in.; that is, $\frac{3}{4}$ in. In other words, the throat radius of a die for drawing the $\frac{1}{4}$-in. tube for Welsbach mantle supports is the same as the radius for the throat of a die for drawing a 3-in. brass rail for a $2\frac{3}{4}$ per cent. beer dispensary. I have seen a great number of these dies made and it is my recollection that the throat radius varies with the tube diameter, material and reduction desired at one pass.

In the first paragraph of the article, Mr. Schafer mentions that the steel contains "about 1.1 per cent. of carbon," and at the thirteenth line from the bottom of the first column on page 1151, he says:

"Dies treated in this manner, if of the proper steel, will indicate on the scleroscope from 90 to 100 on the wearing surface, and if fractured will show a *carbon penetration* of from $\frac{1}{8}$ to $\frac{5}{32}$ in. on the inner surface. The outside of the die remains soft and acts as a retaining ring for the inside."

If the dies are made of "Pompton 33" or any other carbon steel, the carbon is *equally* distributed *throughout the entire die;* in other words, the carbon *penetrates* every portion of the charge during manufacture in the electric furnace or the crucible, and permeates each and every part of each and every bar rolled from the ingots.

Penetration of carbon is usually referred to in connection with carburizing or case-hardening where iron or low-carbon steel is packed in some form of carbon and raised to and kept at a high temperature. Hot iron or steel has a great affinity for carbon, and when thus heated in close proximity to carbon, the carbon *penetrates* the iron or low-carbon steel. This affinity of steel and iron for carbon is one of the reasons why crucible steel varies in its carbon content, because a charge in a graphite (carbon) crucible is apt to absorb some of the carbon from the crucible itself, and the steel maker may start out to make, say, 0.90 per cent. carbon steel and find that the finished product contains 1.20 per cent. carbon.

Possibly Mr. Schafer means that the extreme hardness penetrates for the distance mentioned, but even this is doubtful, for if he will split a die in half and test it, he will find that the hardness decreases the further it is removed from the hard surface.

This decrease in hardness is very noticeable in large work and the steel ball makers have to contend with it in their business, for it has been found practically impossible to harden a ball larger than $1\frac{1}{2}$ in. in diameter *clear through.*

On page 1151 in the second column the statement is made that the dies "should not be shrunk and reground more than four times" because they "will no longer fit the bench head." It seems to me that if this is the *only* reason, what is wanted is not a blacksmith but a designer to devise a head that they will fit no matter how often they are shrunk. In the drawn steel shafting industry the dies are similar and treated in a similar manner but I have seen a die for $\frac{5}{16}$-in. drawn rod, that has been drawing $\frac{5}{16}$-in. rod, day in and day out, for over 10 years. As the wear allowance is only from 0.002 in. under size to standard size, this die must have been shrunk hundreds of times.

It would be interesting to know just how the magnetic chuck is used in connection with *hole* grinding; also the speed of 10,000 r.p.m. seems entirely too high for a 4-in. wheel and entirely too slow for a $1\frac{1}{2}$-in. wheel, as the surface speed of a 4-in. wheel is about 1 ft. per revolution and of a $1\frac{1}{2}$-in. wheel, about 1 ft. per $2\frac{1}{2}$ revolutions. This gives surface speeds of 10,000 ft. and 4000 ft. respectively, whereas surface speeds usually recommended by manufacturers are 5000 to 7500 ft. per minute.

Oversea Lumberman's Machine Shop

By Capt. John B. Woods

The service of supply of our expeditionary force has come in for its full share of abuse and criticism, but it is worthy of note that the first unit of our armies to be officially decorated with the fourragere was a supply unit. Most of the units did not get within hailing distance of the front line but they had difficulties enough to overcome to prevent them from worrying much about glory

IN THE broad scheme of things mechanical upon which the active war works of our expeditionary force were founded, an interesting and not unimportant place was held by the American sawmills. From an early start with eight mills and 1000 men, this department grew to a strength of 40,000 men, operating 80 American lumber manufacturing plants. The organization was by districts, scattered about through the timbered regions of France, each district comprising four or five working units in command of a major, and operating directly under the orders of the construction and forestry office in the Supply Service.

There was one district in southern France that comprised five sawmills, and carried upon its field return something like 1500 men and 20 officers. The headquarters was in a central location, where supplies were received and general orders as to operation and shipments issued. There was also a motor camp here, a lumber yard, a railroad office, and later on, a machine shop. To furnish logs to all the mills and to deliver lumber promptly to the main line of the Midi R.R., 50 miles of narrow-gage railroad were operated in the woods and 25 miles of standard French line were under American maintenance and operation. In short there was a mechanical plant of five complete, steam-driven, electrically lighted sawmills, four locomotives and 200 narrow-gage log cars, two standard-gage locomotives and several work cars, half a dozen gasoline speeders, a steam skidding engine, a motor boat, and 20 motor vehicles, as well as several motorcycles and side-car rigs.

In the United States when a man builds a big lumber plant, he invariably includes in his equipment a more or less complete machine shop, in spite of the fact that our machinery houses and mill supply people carry extensive lines of spare parts in all the big towns. But in France there was a lack of spare parts at all times, owing to the growth of the lumber department, and the French machinery importers were practically out of the market on account of the shipping famine. The same comparison held in regard to shop work. At home we were accustomed to having our work done promptly by others when we were unable to do it ourselves, while over there nobody cared to bother with it, having troubles enough in the line of government contracts. Their labor situation was desperate, and they did not enjoy working for us at any price for we always insisted on rush deliveries. The Frenchman cannot understand why we hurry, and is not tempted to imitate us. So our sawmill operators were thrown upon their own resources, and expected to produce the much-needed lumber in spite of breakdowns and wear and tear.

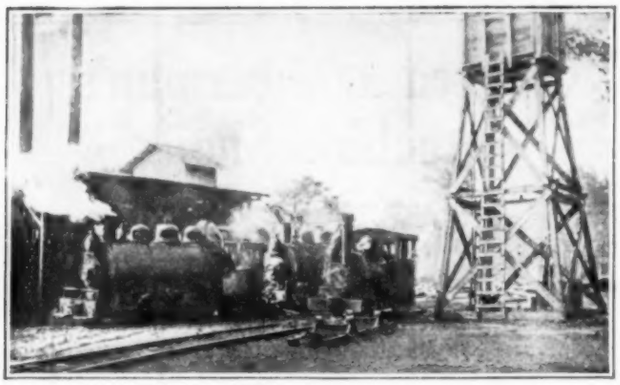
Of course there were many breakdowns. Here were machinery installations, of known capacities, guaranteed by their makers for such work as they really could stand, and we were operating every last one of them—the sawmills—day and night, at greatest possible speed, so that they were producing not twice the guaranteed daily output, but four and five times that amount. Our men were soldiers, skilled for the most part in such work, but careless of minor details and prone to sacrifice the machine to the war need of speed. They did as they were told and delivered the stuff, but the machinery suffered. Breakdowns spelled delay of course, and entailed greater hustling when they were repaired to keep up the output.

On the railroad there were constant tie-ups of traffic owing to breaking car wheels, a matter of defective material and constant overload over rough track, while in the motor truck yard there was a great volume of repair work that could not be done except by sending the vehicles to Bordeaux.

Manifestly the need was a well-found machine shop to render us independent of the French shops and our own distant army repair outfits. With such a plant we could then take care of current breakdown and work on spare parts for stock to guarantee the future.

The Canadians, who operated several mills in our vicinity, had a centralized organization much like our own, except that their mills were more numerous and scattered over a larger territory. They had a big shop at a central point to handle the work of all the mills. Their castings were bought from a French foundry whose manager was a progressive citizen given to getting out orders on short notice—remarkable man—and so they became practically independent of the British Army Engineer Depot in the matter of spare parts. Their equipment represented an outlay, in war price terms, of $25,000 or $30,000 for machines alone, and in addition they had a splendid power plant and electrical equipment. One of the most interesting features of their shop was a home-made lathe, the product of a Yankee who had enlisted in the Canadian army. It was rather a weird thing in appearance, but it worked, which was the main consideration.

One of our own districts had installed a very small shop, with a drill press and lathe, the latter capable of swinging nothing longer than 3 ft. or of more than 8 in. in diameter. When the writer visited this toy

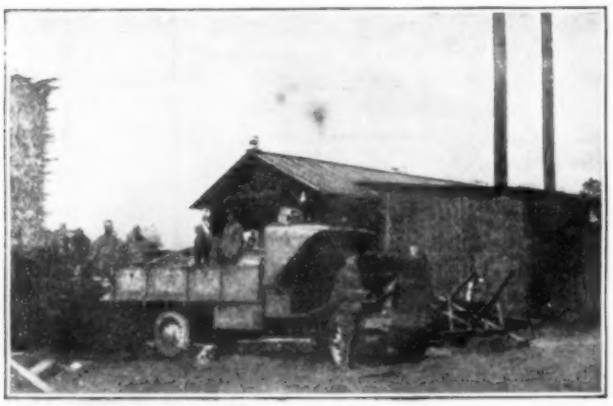


THE DISTRICT MOTIVE POWER

plant, the engineer officer in charge expressed his profound disgust with the outfit and stated that if we, in the district adjoining him, would put in a shop of suitable size and capacity, he would be glad to give us his patronage, thereby helping us to justify to our headquarters the expense we were about to incur.

A survey of all the machine field showed us four sources of equipment. Our engineer depot had in stock several good drill presses and a quantity of small tool sets. The big machines were available from three quarters; American stocks belonging to importers, French stocks, and Swiss importations. Unfortunately the only American machines immediately at hand were lathes, and none of them were big enough for our needs. A number of shapers and planers were lying on the docks at Bordeaux, under customs bond, and the importer would not open a case to show the machines without our promise to buy, which naturally interfered with any attempt to trade. The French stocks embraced small lathes and such items as hacksaws and grinders, but nothing of real value in the big items.

Finally, we decided to buy a Swiss lathe, a fine machine and big enough to swing the greater portion of all our mill and rolling-stock parts. In dealing with this importing firm, we ran foul of the espionage and military law and what not, having a very interesting and lively experience. It seems that the house had been under surveillance for some time, and the very day we sent for our property, in fact while our big truck was backing up to the warehouse door, the French authorities came and closed the place, seizing all the stuff in stock. We just managed to get the lathe aboard ahead of them, but were compelled to leave a set of gears. Then ensued a long exchange of letters and telegrams relative to the missing parts, with the result



HOW THE MOTOR TRUCKS WERE TREATED

that we received a new set from Switzerland by special convoyed express a few days before the armistice. In the meantime, we had made others ourselves in a French shop by sending our workmen to do the work. When we came to pay for the lathe, we narrowly escaped being compelled to give it up on account of a newly enacted statute relative to purchases of machinery of and above a given amount. But finally we got our equipment assembled and installed, although we never did get any planing or shaping machines. However, we were able to make arrangements with a near-by French shop for the use of both these machines at stated times by furnishing workman and tools.

Our big lathe was the saving feature of our shop. Then we had a small one, bought at second hand, for automobile work. A good large drill press, a hacksaw, a milling attachment for the big lathe, grinders and other odds and ends of small machinery, including a bandsaw for pattern making completed the layout. A well-found blacksmith shop was placed in a room at one side and included an oxyacetylene welding rig so that we were able to attempt such delicate operations as welding and balancing mill pulleys and mending broken auto engines. Power was obtained from an old French return-tubular portable boiler and engine combination of 20-hp. rating. With this we turned a generator and furnished light for the entire headquarters colony as well as for the shop.

Modeled After the Usual Lumber-Jack Structure

The building in which we housed all this was modeled after the usual lumber-jack structure, a light stud-framed affair with the walls of 1-in. boards and the roof of patent paper. Because there were two rooms containing no machinery, namely a motor-assembly room and the blacksmith shop, we restricted the use of heavy timbers to the actual transmission needs, placing a stout framework inside the walls to carry the shafting. Then we laid a 3-in. plank floor under all, and found that for temporary use such as ours, this was entirely satisfactory and free from vibration. A track skirted one side of the building, the supply warehouse was hard by, and the motor yard immediately in front, making everything accessible. The writer has gone to some length in describing this plant, meagerly equipped though it was, because in the making it was a big production, entailing a great deal of worry and argument in the face of a machinery famine and official red tape; and then too, it really was the biggest affair of its kind in our part of the woods and we admired it accordingly. Really the only satisfaction of working back in the S. O. S., was the knowledge that one was producing something without much in the way of tools, and that product badly needed by the army.

The district was combed for machinists, and two shifts of five men each took over the repair business. Of course the army system had found out the qualifications of every man in every company and entered them upon indexed cards for reference in just such emergencies, so ostensibly the thing to do was to refer to the qualification cards of every man in the district and pick out enough rated machinists. But as a matter of fact, we found the best men by accident, for many of the self-professed experts were simply men who had been employed for short periods in the shop or garage and preferred trying their luck at such work rather than doing heavy manual labor in the mills. One man furnished more or less amusement. He was very

short, scarcely 5 ft. in height, and had been put into the infantry from the first draft. Then because he had given his employment as "machine hand," he had been rated as a machinist and transferred to the engineers, coming eventually to us. As a matter of fact, he had been engaged in milling a certain very small part of a Bosch magneto in an American factory, and could not even operate a milling machine or anything else. At one time a visiting general came upon this lad at his post as orderly in a company office—which was the place he could fill best—and demanded: "Boy, I don't understand why they ever took you in the army, you're too small. How did you get in?" The private stood as stiff as he could, and tipping his head back to look up into the questioner's face, he replied: "General, you and I feel the same way about this thing, and I'm doggoned if I know!"

But good men were found eventually, and in a short time a steady stream of car wheels, pulleys and jobs of

THE BEGINNINGS OF THE MACHINE SHOP

many kinds was coming out of the shop. We also managed to make a deal with a live foundryman, and were able to obtain castings on one week's notice. Current repairs were taken care of with dispatch, and a stock of spare parts soon appeared upon the supply man's shelves. The motor trucks profited greatly, much to the transportation officer's joy. On armistice day a soldier, fearing that no chance would be given for enjoyment of the occasion, removed the collar nut from one of the big main saws and threw it into the log pond. Of course, he expected a shutdown to result, but thanks to the machine shop, there were other collar nuts in stock and the mill started up the morning after the holiday. He went into the brig while everybody else enjoyed the vacation, which was fore-ordained anyway by a general order.

The Cleaning of Metal Parts

By W. H. Addis

In many factories there are large quantities of metal parts, the product of automatic screw machines, punch presses, coloring machines and the like, which only require a thorough washing to remove the oil and dirt of machining to make them clean and ready for the next operation or final assembly.

One plant uses for this purpose the large concrete-mixing machine shown in Fig. 1. The interior of the drum is lined with wooden slats which have fixed to their inner surface a spiral guide of proper pitch to

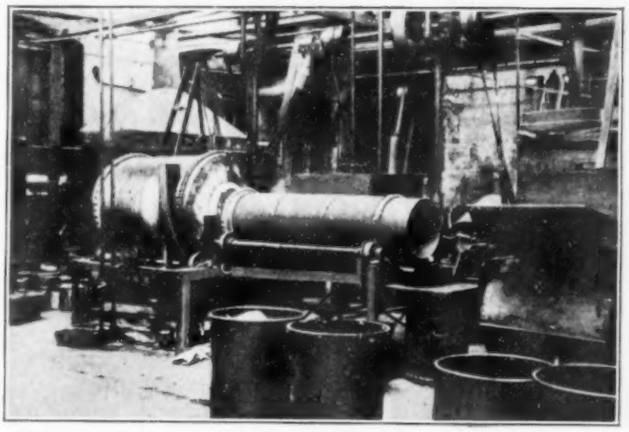


FIG. 1. CONCRETE MIXER AS METAL PARTS CLEANER

lead the work through the drum to the discharge tube. Directly beneath the drum will be seen a rectangular tank which contains the soda water that is used as a cleaning agent. This is supplied hot to the interior of the drum by a small rotary pump.

As the work is led through the washer to the discharge tube it is drained of all excess soda water, owing to the fact that the discharge tube is made of heavy metal screen. The interior of the discharge tube contains a screw of much more rank lead than the washer drum, this serving to hasten the work through the tube where it is discharged into tote barrels or pans.

The work absorbs enough heat from the hot soda water in its travel through the drum to be thoroughly dried when discharged from the washer. In the illustration a small rectangular tank will be seen directly behind the discharge tube. This is used as a storage tank for the soda water and is heated by a gas burner, as is also the tank beneath the drum. This apparatus will actually clean the work as fast as it can be loaded.

Tumbling Barrels

The tumbling-barrel equipment shown in Figs. 2 and 3 is very complete and offers many valuable suggestions. The work handled covers a wide range of burnishing, cleaning and drying. In Fig. 2 the burnishing barrels are shown with the heads removed. The work to be burnished is loaded into the barrel with a quantity of hardened punch-press slugs and water. The slugs are scrap from regular operations on chrome-nickel or 0.40-carbon steel, and the cost of hardening is the

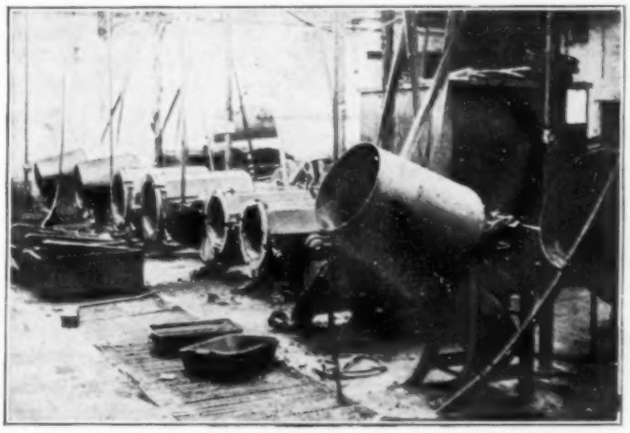


FIG. 2. BURNISHING BARRELS AND DRYING TUMBLERS

only outlay for this fine cleaning and burnishing material. About 15 min. of tumbling and the work is well cleaned and burnished. The barrels are opened and lowered directly over the large dump pans, which have perforated bottoms and rest on the iron grid which covers the sunken drain. A foundry riddle of suitable mesh to screen the slugs is now placed on the inclined ways of the dump pan, and the work is dumped from the barrel into the riddle, the water draining through to the floor drain while the operator now riddles the slugs from the work by sliding the riddle back and forth on the inclined ways of the dump pan.

These ways also assist the operator in bringing the riddle full of cleaned work up to a convenient level where he can lift it and, turning around, dump its contents into one of the drying tumblers which will be seen at the right in Fig. 3. Some of these drying

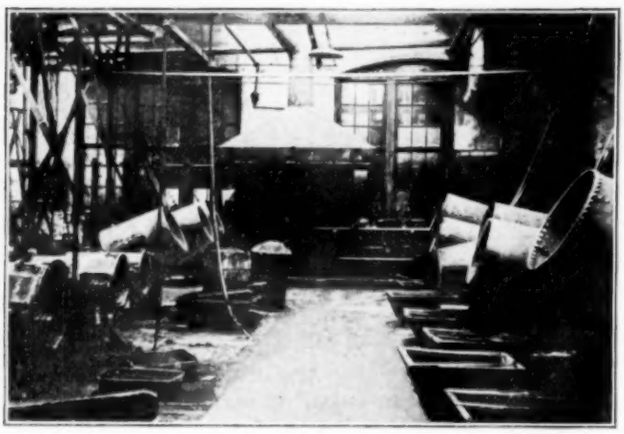


FIG. 3. TUMBLERS AND SODA KETTLES

tumblers are provided with a gas heater which hastens the drying, but the most efficient drying material is white-ash sawdust, which is shoveled into the tumbler with the work. Probably the most striking thing about this tumbler equipment is the method of draining the waste water from the work, as there is none of the slop and discomfort so common to this class of equipment. The large soda kettles with the hooded ventilator, which may be seen in the center of Fig. 3, are used for cleaning dies, tools and delicate parts that will not permit tumbling.

As this particular cleaning room often handles well toward a 1,000,000 lb. of work in a month's time it will be of interest to study the human side also. The whole cleaning force is put on a flat base rate for the day's labor, but as an incentive to special effort those comprising the force all share alike in the tonnage which they may clean in excess of their base rate. This prorating of the excess tonnage among the whole force gives an equitable return to all, for the work often varies in weight and the time required to clean it. It is satisfactory to the men, and is quite an inducement for team work. This plan has been in use for two years and shows a very satisfactory gain in production over the old day rate.

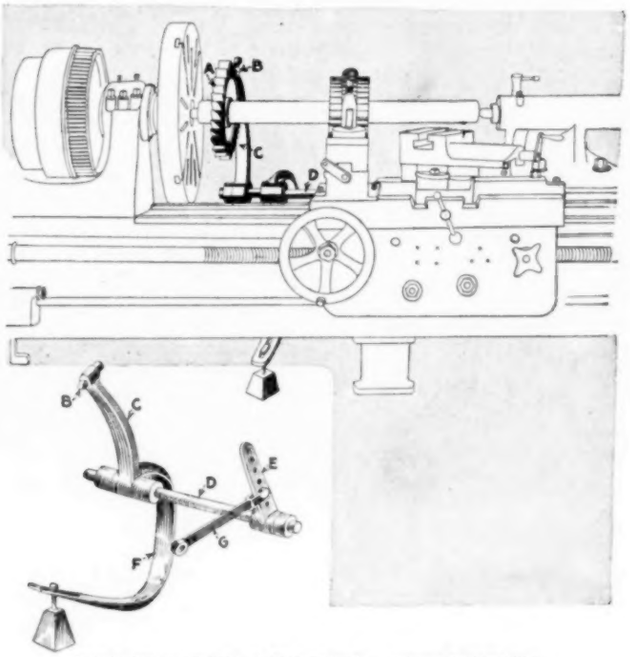
In plants where it can be centrally located the cleaning room may be used to great advantage as a works clearing house. With the installation of an accurate set of scales, weights of orders in production may be checked and verified. It is also an important way station for the planning room, for in most cases operations are completed when the parts move to the laundry to be cleaned. If all material is so routed that it must clear through the laundry while in progress from department to department, and every clearance is properly receipted, weighed and the records filed, it leaves an indisputable testimony that is often of great value in tracing and checking the progress of work through the plant.

An Improvised Relieving Attachment

By R. B. Frank

The sketch shows a simple form of relieving attachment to be used in a lathe for backing off cutters and similar work.

The ratchet *A* has notches equal in number to the teeth of the cutter that is to be backed off. The follower



CUTTER-TOOTH RELIEVING ATTACHMENT

B acts on this ratchet imparting through the lever *C* a rocking movement to the shaft *D* which is mounted at the back of the lathe and which also carries the levers *E* and *F*.

The lever *E* has holes in it for attaching one end of the link *G*, the other end being connected to the tool slide. The lever *F* passes under the lathe and has a weight attached to it to keep the follower in contact with the ratchet. The crossfeed screw is removed from the tool slide leaving it free to be controlled by the lever *F* through the connection *G*.

It will be seen that when the lathe revolves a reciprocating motion is imparted to the tool and the shape of the ratchet teeth will be duplicated in proportion upon those of the cutter. The ratchet and cutter must be solidly attached to the same mandrel so that no relative movement may take place. The lathe must be run slow to give the cutter a chance to pull out between teeth. The tool is fed in a little every few revolutions by the compound slide.

Holes are provided in the lever *E* for varying the amplitude of the backing-off movement. A ratchet is required for each number of teeth. The form tool with which the cutter was originally turned should be used for relieving it.

Effect of Corrosion on Wrought Manganese Bronze Under Tensile Stress*

By P. D. MERICA and R. W. WOODWARD

Specimens of wrought manganese bronze rods were exposed in special test frames to corrosion in water and moist air while at the same time under tensile stress, with the object of determining the maximum safe stresses for this material under these conditions. While the period of exposure was only two years, these tests indicate that the proportional limit is to be regarded as the maximum safe stress for bronze of harder tempers, but that it is not certain that this limit may not be slightly exceeded in materials which are soft; that is, free from work hardness.

IN THE course of a previous investigation by the authors of a series of failures by fracturing of brass and bronze bolts, it was suspected that many cases of such failure were due not to defective material but to the fact that the bolts had been overstressed in service. Careful examination of these bolts revealed a normal and sound structure and satisfactory mechanical properties; the bolts were comparatively free from initial stresses which would have caused corrosion cracking. No other cause of failure could well be assigned other than that they had actually been overstressed in tightening up.

The question was thus raised: What service stresses may with safety be applied to physically normal wrought brass and bronze and the types ordinarily used for structural purposes? The failed bolts in question had probably not been stressed above from 15,000 to 20,000 lb. per sq.in.; their tensile strength was about 60,000, their yield point about 30,000 lb. per sq.in. The service stresses were thus presumably not above the yield point.

An interesting investigation showed that brass rods exposed to the action of concentrated ammonium hydroxide and subjected at the same time to the very gradual application of tensile stress would break with little elongation at any values of the stress greater than the yield point of the material. Fracture occurred within from 6 to 20 days.

The effect of combined tensile stress and surface corrosion is therefore apparently to decrease the stress at which fracture will occur.

The corrosive action of this solution is very severe and yet many, including the authors, believed that its action under these conditions was not different in principle, but only more rapid, from that of water or moist air in which brass or bronze bolts might actually be placed in service. It was believed that this investigation demonstrated that wrought brass or bronze could be used only for very low stresses and with high factors of safety, whenever corrosion was to be expected. In view of the fact that these materials would supplant steel usually only because of their superior resistance to corrosion, the verdict of the work seemed to limit very largely the usefulness of brass and bronze for structural purposes at least until more reassuring information concerning their behavior in service might be obtained.

The authors have therefore undertaken to discover whether corrosion by water and moist air will produce the same effect in combination with the simultaneous application of tensile stress as that of ammonium hydroxide. Bars of wrought manganese bronze were exposed to corrosion in water and moist air, while at the same time under tensile stresses of different values. Although the period of exposure has been to date only two years, it is thought that a report of the behavior of these bars during that relatively short period will be of interest to those using and manufacturing this material.

Since much longer periods than the few days of the investigation were contemplated, small test frames were used for these tests rather than standard tension testing machines for the application of tensile stress to the specimens. Twelve such frames were made in each of which a brass bar specimen could be placed in tension of any required amount, and the value of the stress determined by strain-gage measurements on a steel reference bar placed "in series" with the brass

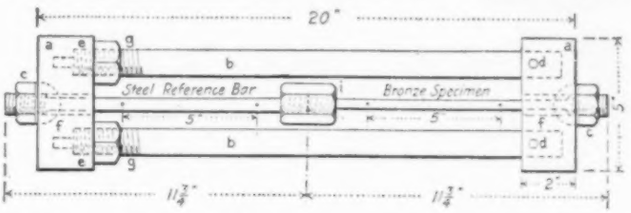


FIG. 1. FRAME USED IN THE STRESS CORROSION TEST

test specimen; that is, such that the same total load was borne by the steel reference bar as by the test specimen.

Each frame, Fig. 1, consists of two blocks of steel *aa*, which can be braced apart by the two rods *bb*, of which one end is secured by pins *dd* against rotation, while the other fits in the bored holes *ee*. The brass specimens and the steel reference bars are threaded at the ends and secured by nuts *cc* at the ends and by the coupling nut *i* at the center. A ball-and-socket joint is provided at *ff* to secure axial loading. The center member of these frames, consisting of the steel reference bar and the brass test specimen, can be placed under a tensile load of any desired value by the adjustment of the nuts *gg* against the block *a*.

The test specimens were cut from ¾-in. round bars; they were 11¾ in. long and 0.50 in. in diameter and had standard ¾-in. threaded ends. The steel reference bars for the extensometer measurements were also 11¾ in. long, were of two diameters, 0.420 and 0.350 in., and had also standard ¾-in. threaded ends.

An alloy-steel rod kindly furnished by the Midvale Steel Co. was used for the preparation of the steel reference bars. This was heat-treated to produce a high elastic limit and the section of the rod was so chosen as to allow of the utilization of the full elasticity of the rod in each individual measurement of stress.

In this first series of tests only one type of brass

*Presented at the annual meeting of the American Society for Testing Materials, Atlantic City, N. J., June 24-27, 1919.

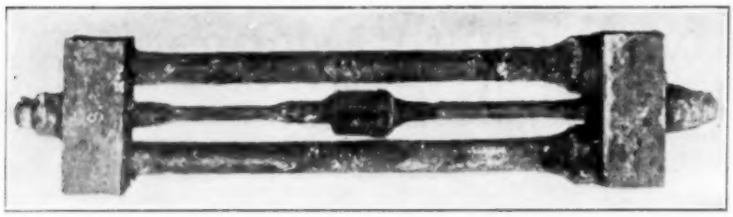


FIG. 2. FRAME NO. 8 WITH SPECIMEN NO. 239-B AFTER ABOUT ONE YEAR'S EXPOSURE TO CORROSION UNDER A TENSILE STRESS OF APPROXIMATELY 43,000 LB. PER SQ.IN.

was used; namely, manganese bronze. The American Brass Co. very kindly furnished ¾-in. round rods of this material in three tempers or degrees of hardness, Nos. M 237, M 238 and M 239, as well as the results of chemical analysis and of mechanical tests of the rods. These data are given in Table I.

TABLE I.—CHEMICAL ANALYSIS AND MECHANICAL PROPERTIES OF THE THREE SAMPLES OF WROUGHT MANGANESE-BRONZE USED IN THE TESTS[1]

Elements	Rods No. M 237	Rods No. M 238	Rods No. M 239
Chemical Analysis			
Copper, per cent	56.64	56.87	56.60
Zinc,[2] per cent	40.94	41.07	41.01
Tin, per cent	1.26	1.20	1.18
Lead, per cent	0.12	0.08	0.11
Iron, per cent	0.85	0.68	0.91
Manganese, per cent	0.19	0.10	0.19
Mechanical Properties			
Tensile strength, lb. per sq.in.	84 700	89 050	101 650
Yield point, lb. per sq.in.	44 050	59 550	73 350
Elongation in 2 in., per cent	29	22	14
Reduction of area, per cent	25	19	10
Brinell hardness[3]	117	137	158
Scleroscope hardness[3]	36	43	49

[1] These values were furnished by the American Brass Co.
[2] By difference.
[3] Taken at the center of the section of the rod.

These rods, as furnished, were in a condition of more or less initial stress, and as it was not desired to have the interpretation of the results of these tests complicated by their presence, the rods were annealed between 285 and 315 deg. C. in a salt bath for five hours and slowly cooled. This temperature, it has been shown, is sufficient to relieve initial stress in manganese bronze but does not markedly soften the material.

Determination of the proportional limit of a bar of each group after this annealing showed the following results:

	Proportional Limit.
No. M 237	25,000 lb. per sq.in.
No. M 238	35,000 lb. per sq.in.
No. M 239	42,500 lb. per sq.in.

The moduli of elasticity of all of the bars were practically the same; namely, 16,000,000 lb. per square inch.

From each group of brass rods of the same temper were prepared four test specimens. These were placed in the frames and tensile stresses of different values, given in Table II, applied to them. Three specimens of each group, or a total of nine, were exposed to corrosion. Of each group one specimen was stressed just to the proportional limit, one was stressed to a value of the stress just above the proportional limit, and one to a value just below it. Three test specimens, one of each group, were stressed just above the proportional limit, and then covered with paraffin as a protection against corrosion; these specimens were preserved in the laboratory as comparison specimens during the period of the test.

For the measurement of stress a 5-in. strain gage reading to 0.0001 in. was used, and on each bar two sets of holes for the gage points were placed on opposite sides. The difference in the strain-gage reading before and after loading the bars by tightening up the nuts *gg* or unloading by loosening the nuts, allowed of the calculation of the applied stress. That the stresses were applied approximately axially is shown by the fact that the extensions of the two opposite fibers of each bar usually agreed in value within less than 5 per cent.; in a few cases the agreement was only within 10 per cent.

The average value of the extensions on the two opposite sides was used in the calculation of stress.

After applying the desired stresses to all of the specimens in the frames, they were allowed to lie for a few days and were then re-gaged. Only insignificant changes in length and consequently of stress had occurred in that time. The frames were then wrapped in cloth and painted with red lead, and the steel reference bars covered with a layer of paraffin as a protection against corrosion. All gage-point holes were also carefully wrapped with cloth and paraffined. The portion of the brass test specimens in frames Nos. 1 to 9 between gage point holes was left bare and unprotected; the test specimens in frames Nos. 10 to 12 were paraffined.

TABLE II.—PROPORTIONAL LIMITS OF THE TEST SPECIMENS AND APPROXIMATE TEST STRESSES APPLIED TO THEM

Frame No.	Specimen No.	Proportional Limit, Lb. per Sq.In.	Approximate Test Stress, Lb. per Sq.In.
1	M 237-A	25,000	15,000
2	M 237-C	25,000	25,000
3	M 237-D	25,000	30,000
4	M 238-A	35,000	20,000
5	M 238-C	35,000	35,000
6	M 238-D	35,000	40,000
7	M 239-A	42,500	25,000
8	M 239-B	42,500	42,500
9	M 239-C	42,500	47,500
10	M 237-B	25,000	30,000
11	M 238-B	35,000	40,000
12	M 239-D	42,500	45,000

Frames Nos. 1 to 9 were then placed near the top of a water surge tank in an engine room such that they were alternately immersed in water and exposed to the air. Frames Nos. 10, 11 and 12 were laid away in the laboratory. This was done on Dec. 22, 1916. On March 2, 1917, the frames were removed and examined. No cracks or fractures had appeared; the brass had tarnished badly. On March 13, the tensile stress in each test specimen was relieved and measured; on March 15 the test stress was again applied, measured, and on April 6 the frames were put back in the tank. On June 12 they were again removed and examined. No cracks had appeared but the corrosion had progressed and the surface of the test bars were of a greenish-brown color. The frames were placed by error at this time outside the tank and were exposed to the fumes and smoke of the boiler room but remained

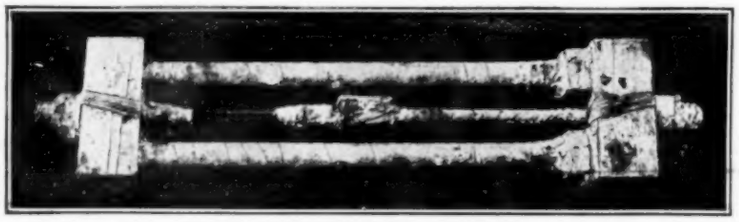


FIG. 3. FRAME NO. 9 WITH SPECIMEN NO. 239-C AFTER TWO YEARS' EXPOSURE TO CORROSION UNDER A TEST STRESS OF ABOUT 45,000 LB. PER SQ.IN.

fairly dry. On Oct. 10, 1917, the frames were replaced in the tank. On March 4, 1918, they were removed for examination. Specimen No. 239-B in frame No. 8 had fractured, evidently quite recently, judging by the brightness of the fractured surfaces. Fig. 2 shows the appearance of this frame and specimen after fracture. The other specimens were quite sound. All of the frames except No. 8 were replaced in the tank on Mar. 10, 1918. On Dec. 30, 1918, upon searching for these frames, it was discovered that about Aug. 1, they had been removed from the tank by plumbers and placed back of it. When found, frames Nos. 2, 6 and 9 were entirely immersed in dirty water; Nos. 3, 4 and 5 were partly immersed, lying on top of the others. Nos. 1 and 7 were in another location which was dry at the time of examination. The latter frames were quite dirty as were indeed all of the frames, being covered with black mud, and they had evidently been in the water or had been sprayed with water from the hose while in that location.

All of the brass specimens, after washing off the mud, showed that they had been moderately corroded, the surfaces being covered with a heavy dark-reddish-brown patina.

Specimen No. 238-D in frame No. 6 was fractured. No other fractures or cracks were noticed in any of the specimens. Fig. 3 shows the appearance of frame No. 9 as it was found on Dec. 30.

The stresses in some of the frames were found to have been slightly reduced during the last exposure period. It is suspected that upon removing the frames from the tank they were dropped or otherwise roughly handled, thus causing the nuts to loosen.

In Table III will be found the values of the stress applied to the different brass specimens as measured at each loading and unloading. The first value in each case is that measured on the steel bar. In the third column is the value of the extension produced in the brass bar, and in the second column of each group, the value of the stress in that bar calculated from its own extension, using 16,000,000 lb. per sq.in. as the modulus.

It will be noticed that the values of the stress calculated from the extensions of the steel bar agree well with those calculated from the extensions of the brass bar except on the first loading. The brass specimens in frames Nos. 2, 3, 5, 6, 10 and 11 evidently yielded slightly and took a permanent set upon their first loading; the stress values in the second column therefore have no meaning in this case.

In considering the results of these tests it must be emphasized that the period of exposure, two years, during which the bars have been observed is relatively short in comparison with the periods for which such materials may actually be used in service. The test bars used were given a low temperature anneal, also, in order to relieve the initial stresses, and consequently their behavior may differ during test from that of bars in which these stresses still remain. It is quite apparent, therefore, that any conclusions to be derived from these results must be regarded as quite restricted in their definite application and as more or less tentative in their more general aspects.

Within the period of exposure of two years no specimen of the wrought manganese bronze fractured under a stress below its proportional limit, and four specimens, Nos. 237-C, 237-D, 238-C and 239-C, did not fracture or crack under a stress which caused slight yielding and permanent set when first applied.

Fracture or cracking did not occur in any bars stressed to values below 35,000 lb. per sq.in. This value does not represent the highest value of the tensile stress withstood during the period of test; specimen No. 239-C in frame No. 9 was still quite sound at the end of two years while under stress of from 45,000 to 48,000 lb. per sq.in. Its behavior is considered somewhat anomalous, however, since specimen No. 239-B of the same temper fractured within about 18 months under a stress of only 41,000 to 45,000 lb. per sq.in. It is predicted that the former specimen will eventually fracture under the higher stress.

One specimen with a proportional limit of 35,000 lb. per sq.in. fractured under a tensile stress of approximately 40,000 lb. per sq.in., and another with a proportional limit of 42,500 lb. per sq.in., under a stress of approximately 43,000 lb. per sq.in.

None of the bars in frames Nos. 10, 11 and 12, which

TABLE III. STRESSES AND EXTENSIONS IN MANGANESE-BRONZE AS MEASURED DURING LOADING AND UNLOADING AT DIFFERENT TIMES DURING THE TEST

Frame No.	Specimen No.	First Loading. Dec. 6, 1916.			Re-Gaging. Dec. 15, 1916.			First Unloading. March 13, 1917.			Second Loading. March 15, 1917.			Second Unloading. Jan. 3, 1919.		
		Stress in Specimen, lb. per sq. in. (1)	Stress in Specimen, lb. per sq. in. (2)	Extension of Specimen, 0.001 in. (3)	Stress in Specimen, lb. per sq. in. (1)	Stress in Specimen, lb. per sq. in. (2)	Extension of Specimen, 0.001 in. (3)	Stress in Specimen, lb. per sq. in. (1)	Stress in Specimen, lb. per sq. in. (2)	Extension of Specimen, 0.001 in. (3)	Stress in Specimen, lb. per sq. in. (1)	Stress in Specimen, lb. per sq. in. (2)	Extension of Specimen, 0.001 in. (3)	Stress in Specimen, lb. per sq. in. (1)	Stress in Specimen, lb. per sq. in. (2)	Extension of Specimen, 0.001 in. (3)
1	M 237-A	15 000	16 300	5.1	.....	.....	....	17 800	17 600	5.5	14 500	16 300	5.1	14 500	13 100	4.1
2	M 237-C	24 600	31 000	9.7	25 000	30 400	9.5	28 000	28 800	9.0	24 500	25 600	8.0	21 800	21 700	6.8
3	M 237-D	31 000	41 000	12.8	28 900	42 000	13.1	32 300	34 900	10.9	30 200	32 000	10.0	22 400	23 600	7.4
4	M 238-A	19 500	19 500	6.1	.....	.....	....	20 400	21 000	6.6	19 600	18 900	5.9	18 400	18 200	5.7
5	M 238-C	35 000	47 700	14.9	34 800	48 300	15.1	38 400	39 600	12.4	35 300	34 000	10.6	33 400	33 700	10.2
6	M 238-D	39 000	56 000	17.5	39 700	57 000	17.8	40 500	43 200	13.5	40 600	39 400	12.3		Broken	
7	M 239-A	25 000	25 300	7.9	25 300	25 600	8.0	27 000	28 200	8.8	24 500	23 300	7.3	21 600	21 100	6.6
8	M 239-B	43 600	44 500	13.9	.....	.....	....	43 800	44 400	13.9	42 600	41 400	12.3		Broken	
9	M 239-C	48 600	51 200	16.0	47 200	52 800	16.5	48 500	49 600	15.5	46 500	45 100	12.9	45 100	44 100	13.8
10	M 237-B	30 300	39 400	12.3	29 800	38 700	12.1	.....	.....	....	.....	.....	....	39 700	38 100	11.9
11	M 238-B	40 200	49 200	15.4	39 900	49 600	15.5	.....	.....	....	.....	.....	....	43 000	43 200	13.5
12	M 239-D	46 000	49 200	15.4	47 200	49 000	15.3	.....	.....	....	.....	.....	....	51 600	50 800	15.9

(1) This stress calculated from average of strain gage readings on steel comparison bar.
(2) This stress calculated from average of strain gage readings on brass test specimen.
(3) This is expressed directly in 0.001 in. in 5 in. (the gage length was 5 in.).

were protected against corrosion were fractured at the end of the two years.

The results of these tests seem to be partly, at least, in conformity with the conclusions reached by the investigation in which ammonium hydroxide as a corroding medium was used. The conclusion was that brass or bronze might not be subjected to corrosion (in ammonium hydroxide) while under a tensile stress greater than 20,000 lb. per sq.in. or greater than 5000 lb. per sq.in. above the yield point, without danger of failure. The authors' tests indicate that the proportional limit is to be regarded as the maximum safe stress for managanese bronze of harder tempers, but that it is not certain that this limit may not be slightly exceeded in materials which are soft, that is, free from work hardness. Only further exposure tests which are now proceeding will decide this point. From the practical standpoint, it is desirable to know whether it is permissible to tighten a bolt of brass or bronze until it yields slightly or whether rigid care must be exercised that the load applied in tightening is at no time above the yield point.

Assisting the Returned Soldier

By MRS. CRETE R. HUTCHINSON
Publicity Department, American Library Association

IF expansion comes to the American motor industry the army promises many candidates for the new positions. If predictions that American trade and commerce are to have a great development following the war are fulfilled the fighting forces are prepared to do their share. If agriculture is to be made easy for returning soldiers they will bring to that occupation a knowledge of much that has been written about it by experts.

On the returning transports the men are giving their attention through books to the field of industrial and vocational preparation, and among all the specific subjects about which books have been written the three mentioned have aroused the greatest interest.

The desires of the returning men of the service to shine in business, in agriculture, and in the motor industry have been revealed through the activities of the American Library Association, which has placed thousands of volumes on the troop ships and has sent its representatives aboard to serve the men.

In these floating libraries are books of all sorts—fiction, general literature, poetry, drama and vocational works—and all are eagerly read, but there is constant special demand for volumes relating to occupations, among which the three mentioned are in the lead, in the order named.

In agriculture they have received the encouragement of the entire nation, for its importance has been recognized in a new light, the result of the food restraints of the war. The two other subjects have been emphasized by choice after a survey of general conditions.

Our men have learned abroad that American business and business efficiency are worth while. They have recognized their part in the achievements of a victorious army.

The life of the army has given them a very strong interest in the motor, which has represented to them speed and increased force on land and in the air. Upon their return home they want to know all that is to be known about automobile construction and repairs and to become candidates for positions in that branch of activity.

Throughout the return voyages the men are studying these subjects, for the American Library Association has supplied transports with all the books it was able to command on vocational work. Its representatives are in touch with the returning men not only through the records of the applications for books but also through personal contact. Their reports to the home office show what they have learned about the literary needs of the American soldier.

In each generation, youth devotes its attention to speculation as to the most favorable trade or occupation of the near future, and the use that these men have made of their time at sea gives a clue to their judgment of the future.

Another kind of work which is well up to the list of the preferred occupations is that relating to electrical science. Electricity has been the coming highway to prosperity for many years, and still the youth of the country expect further expansion.

The special demands also reveal some striking individual interests as well as the general trend. One man recently asked for a work on embalming, a second for one on ladies' tailoring, and a third for one on stage illumination. The association makes every effort to comply with all requests.

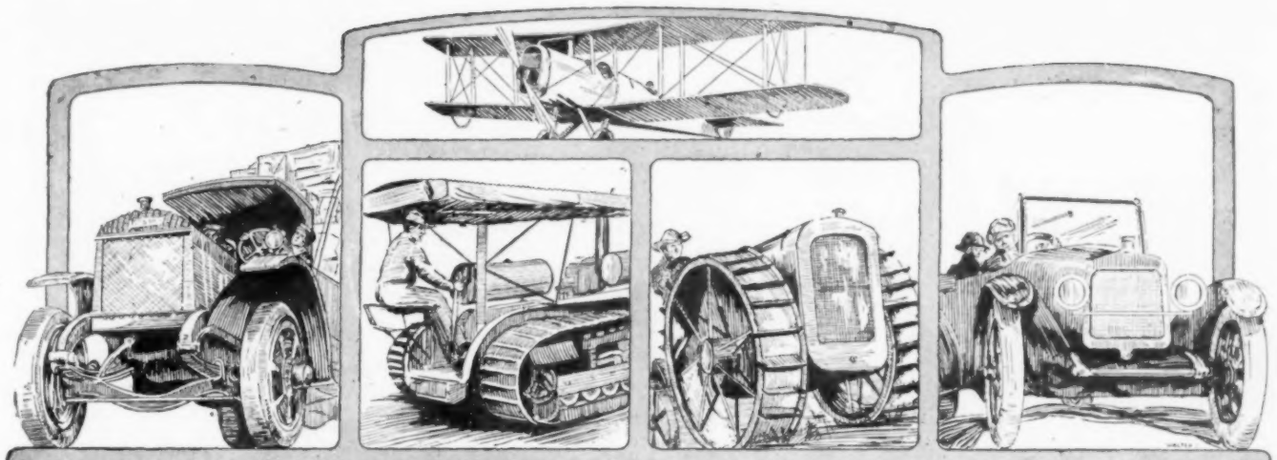
It may be said that the preferences indicated are not confined to the army, for on one of the transports which recently went to France without passengers, to bring back a shipload of troops, books were distributed among the members of the crew, and their requests for vocational works gave first place to automobile construction.

The American Library Association coöperates with all the welfare organizations in helping the men of the service and it is no uncommon thing for the librarians to hold conferences with those who represent the Y. M. C. A., Red Cross, and Knights of Columbus aboard ship, as well as the executive officer and the chaplain, in order that the troops may have the best possible book service.

"The group of welfare workers on the transport," said one library representative, "worked in perfect harmony. I was just as ready to hand out an orange or a package of cigarettes for the 'Y' secretary or a medicine ball or candy for the 'K. of C.' man as they were to aid me. The sick and wounded were the special care of the Red Cross man, and I met his requests for reading matter as far as possible, keeping a small supply of magazines in reserve for this purpose."

The American Library Association has libraries on 150 transports and it aims to have established as the ultimate standard of supply a book and a magazine for every soldier. Its system was inaugurated with the ratio of one book to every four men and one magazine to every three, but as the activities have developed it has been possible to increase the allotment.

Plenty of fiction is read, and there is great interest in all forms of literature, but the vocational works may be regarded as an accurate source of judgment as to the desires of the readers in relation to peace-time pursuits. The book "Your Job Back Home" has been widely read, and applications for the books mentioned have increased.



AUTOMOTIVE CONSTRUCTION

Making Aircraft Fittings With Temporary Tools

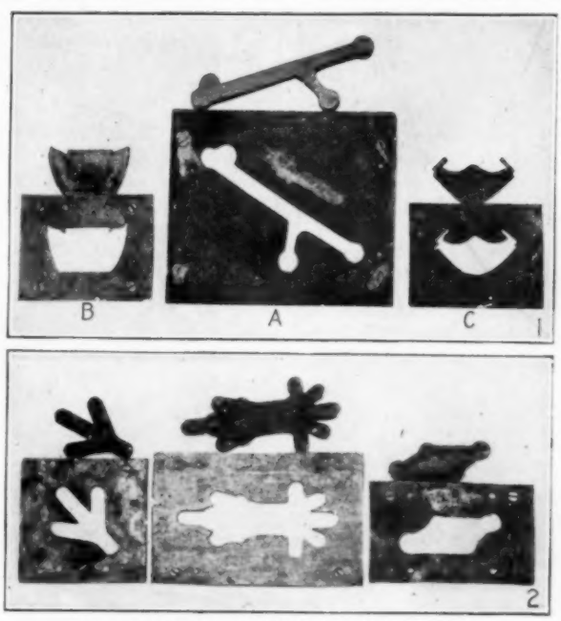
By S. A. Hand
Associate Editor *American Machinist*

In the frenzied haste to furnish aircraft for use in the war, all known expedients had to be resorted to. Many blanked and formed parts were wanted, some of them in quantities that would not warrant making permanent dies, while to produce them by hand would be both expensive and slow. Some temporary tools for work of this character are presented and in one or two instances the time taken to make them is given.

AT THE U. S. Naval Aircraft Factory, League Island Navy Yard, Philadelphia, Penn., many metal parts were wanted as quickly as possible but as the quantity required could not be always definitely determined and as designs were liable to be revised, it was decided to make temporary tools for their production.

Figs. 1 and 2 illustrate punches and dies made of cold-rolled steel and case-hardened. Their construction is shown in Fig. 3 in which *A* is the die, *B* the punch, *C* the guide plate for setting the punch, and *D* is a spacing block to keep the guide plate far enough away from the die to make room for the stock. In making dies of this type both the die and the guide plate are doweled and screwed together without the spacing blocks while the opening is being worked out to size and shape. Afterward the spacing blocks are put in.

In use, the die is put on the press bolster, the stock slipped into place and the punch entered in the guide plate. It is then placed under the press ram. After punching, both the blank and the punch will fall through the die. Almost any press can be used for the work providing it is large and powerful enough. No accurate die setting is required and a few pieces at a time can be blanked out from each of several dies so that a variety of pieces in limited quantity can be furnished without tying up a busy press for any great length of time.



FIGS. 1 AND 2. PUNCHES AND DIES OF COLD-ROLLED STEEL

The die shown at *A*, Fig. 1, has blanked out about 600 pieces of $\frac{3}{16}$ in. sheet steel and shows no appreciable wear. The dies *B* and *C* have sharp corners at several places and could not be expected to have a very long life, though *B* has blanked out 350 pieces and *C* over 500 pieces of $\frac{1}{8}$-in. steel and each is estimated to be good for 1000 more pieces. The dies shown in Fig. 2 are used on stock of varying thickness and have blanked out as many as 9000 pieces and are still in good condition. Such dies as shown in Figs. 1 and 2 can be made in from 10 to 18 hours and when used for small quantity orders are very economical.

Bending and Welding Blocks

Figs. 4 and 5 are two views of an engine block for a hydroplane. The original order for these was for ten pieces and was afterward cut down to four. As even a temporary blanking die for this piece would be expensive, a templet was made from which lines were scribed on the sheet metal to be cut and the actual cutting was done on a Gray sheet-metal cutting machine. Fig. 6 shows the blank as cut out while Fig. 7 shows the cast iron block

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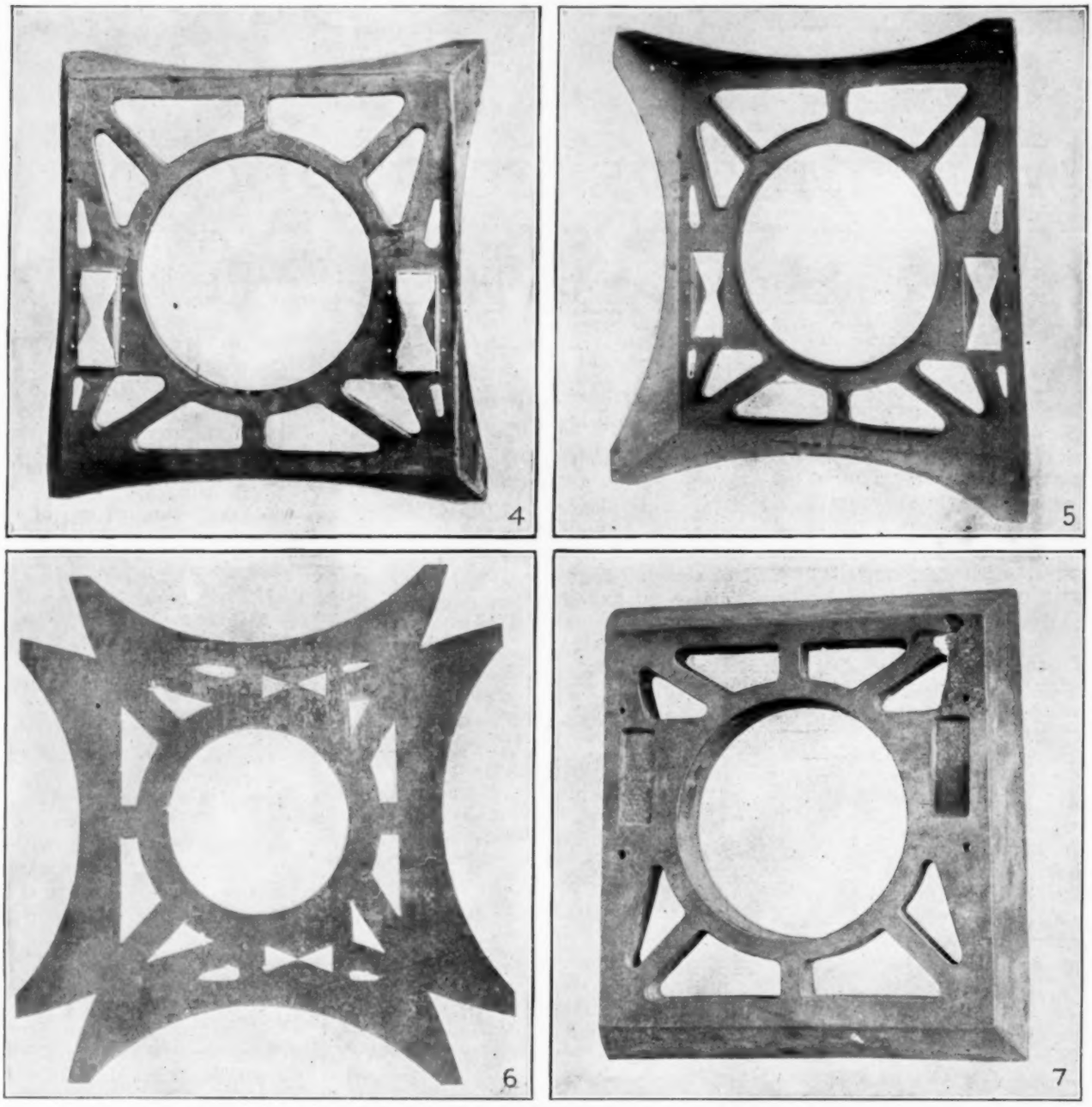
on which it was shaped and welded. With the blank clamped to the block the openings are flanged and the sides bent down by hammering. While still clamped to the block the corners are welded.

Several views of a sidewalk-beam fitting for a seaplane are illustrated in Fig. 8. This is made up from 17 pieces some of which are to be seen in Fig. 9. After blanking out the parts, the fitting is completely built and welded on the block *A*, Fig. 10. After it has cooled somewhat, it is removed and placed on block *B* to which the jig plates *C* and *D* are afterward attached for use in drilling the holes.

Fig. 11 is a piece blanked out in temporary dies and afterward formed into a fitting known as F5L wing beam hinge and used on a 7-ton flying boat of English design. Fig. 12 shows it after the first forming operation, the punch and die for which are shown in Fig. 13. A further stage of forming is illustrated in Fig. 14 where the pins *A* are used to locate and maintain center distances which must be held to ±0.005 in The upper end is formed first and the fitting is then reversed in the die for forming the other end. These fittings were formerly shaped up by hand work, three or four being all one man could complete per day. By use of the dies for the two



FIGS. 4 TO 7. AN ENGINE BLOCK AND THE CAST-IRON FORMING BLOCK
Fig. 4—Top of engine block. Fig. 5—Under side of engine block. Fig. 6—Blank from which the engine block is made. Fig. 7—The cast-iron forming block.

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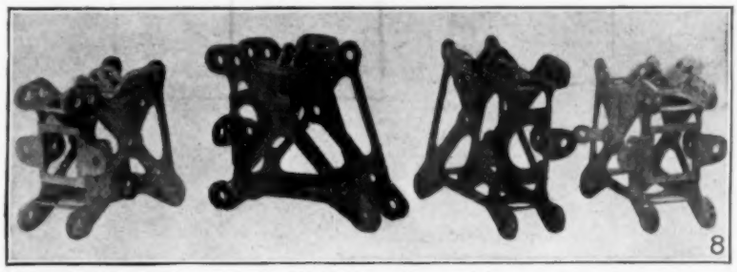
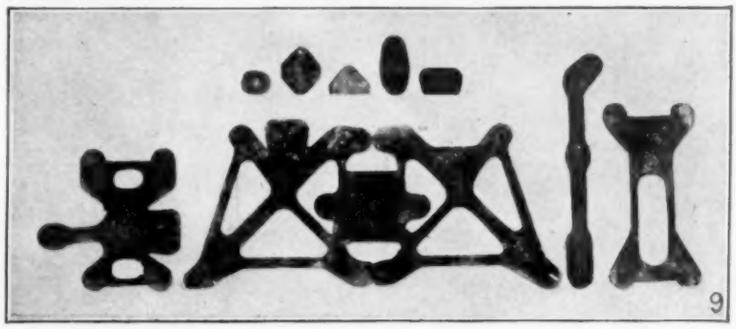




FIGS. 8 TO 10. A SIDEWALK-BEAM FITTING AND SOME OF THE TOOLS FOR ITS PRODUCTION

Fig. 8—The sidewalk-beam fitting. Fig. 9—Some of the parts. Fig. 10—Forming and welding blocks and jigplates

forming operations 100 pieces per day were easily turned out.

Fig. 15 illustrates the method of holding the fitting for welding. The block *A* is inserted in the fitting and bolted to the base of the fixture. Pins *B* are put through both the clamps *C* and the holes formed in the fittings. Then the four sides of the fittings are clamped to the block *A* with screw clamps as shown and each corner tack-welded in two places at *D*. The fitting is removed from the fixture, and the reinforcing pieces *E* are clamped in place and tack-welded after which the fitting is replaced on the fixture and completely welded. It is then squared up on a block *A*, Fig. 16, after which drilling and reaming operations are performed in the jigs *B* and *C*.

Bomb Releasing-Brackets

A large quantity of bomb releasing-brackets for seaplanes was wanted in the shortest time possible. The feet of the supporting brackets *A*, Fig. 17, were bent in a simple fixture and the eye *B* was formed in the fixture *C*. The parts and the fixture for assembling and welding them are shown in Fig. 18 in which *A* is a piece of tubing having four guides or thimbles, for the releasing cord to pass through, brazed in holes previously drilled. The base of the assembling fixture *B* was made of $\frac{1}{4}$-in. sheet steel, and the locating stools *C* fastened to it by spot-welding. Center distances were maintained by loose pins dropped through holes in the bracket feet, stools and base, and the feet were held in place by spring clips.

The rod *D* was placed through one of the thimbles and supported at the proper angle in relation to the brackets by the upright *E*. In this position the guide tube was tack-welded to the bracket eyes; then the whole was removed from the fixture and brazed in an open fire.

Wire terminals of various sizes are made by first blanking out the parts and then bending them into a U-shape in a simple die. After this the legs are closed together and the eyes formed by the universal punch and die, Fig. 19, in which some of the finished terminals are shown at *A*, *B*, *C*, *D* and *E*.

The U-shaped blanks are laid on the die with the bar *G* placed in the bottom of the U as may be seen in Fig.

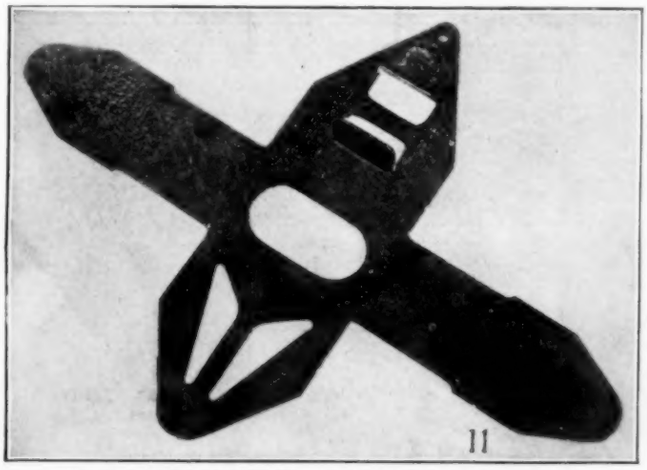


FIG. 11. A BLANK FOR A FLYING-BOAT FITTING

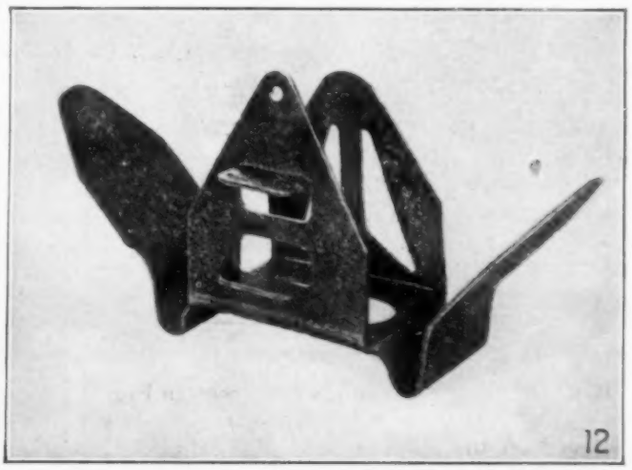


FIG. 12. THE FITTING AFTER FIRST FORMING OPERATION

AUTOMOTIVE CONSTRUCTION

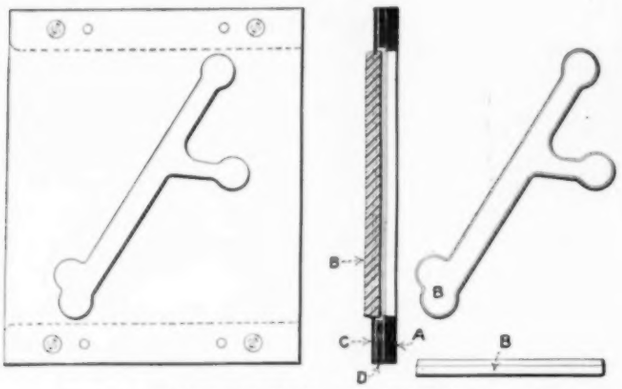
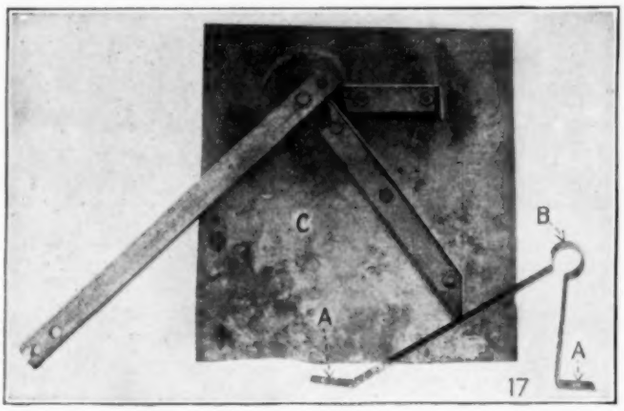


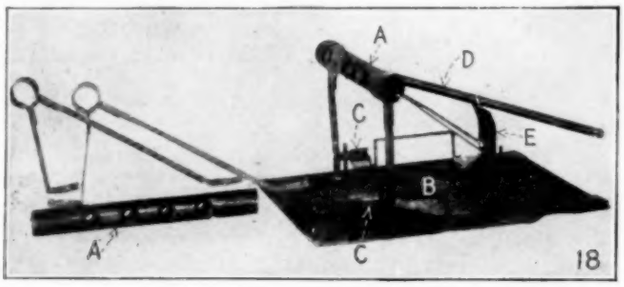
FIG. 3. CONSTRUCTION OF TEMPORARY DIES

20. As the punch closes the legs of the fitting together, it forms the eye around the bar and at the same time the block *H* on the punch forces the eye into a central position. Both the block *H* on the punch and the jaw *I* on the die are adjustable so that eyes can be formed in terminals of various sizes.

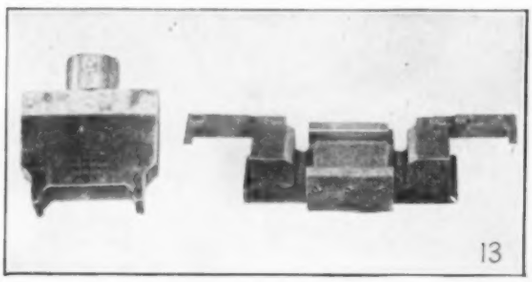
WING-BEAM HINGES

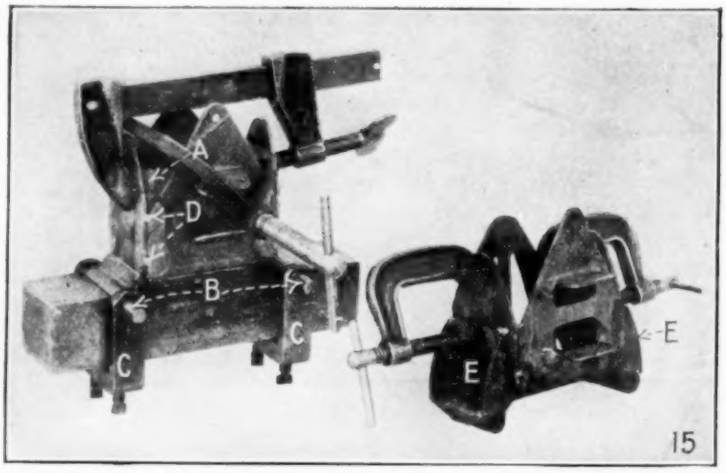
The wing-beam hinge *A*, Fig. 21, is one of several in which holes are to be drilled in slightly different locations. For this purpose a drill jig with detachable parts has been made and is shown at *B*. To provide for drill-

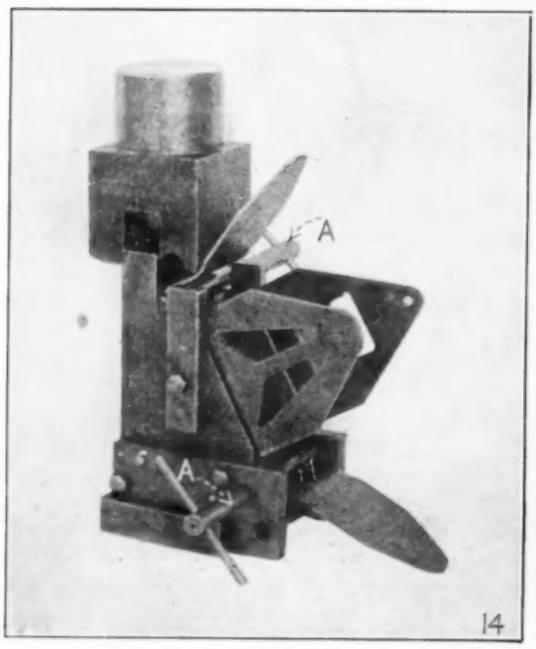


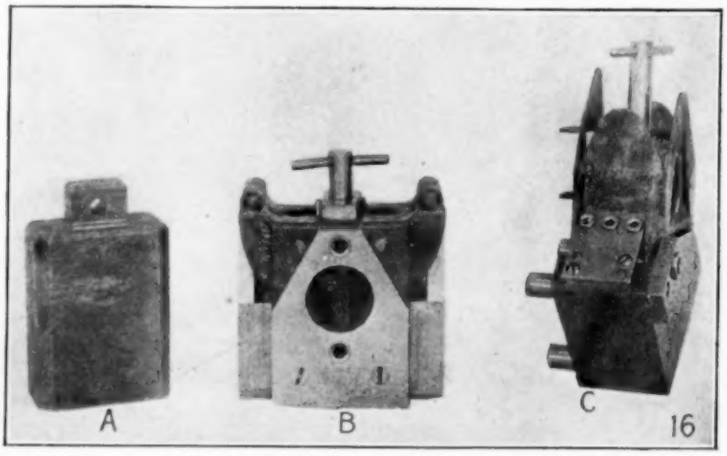


FIGS. 17 AND 18. AN EYE-BENDING AND AN ASSEMBLING FIXTURE FOR BOMB-RELEASING BRACKETS









FIGS. 13 TO 16. TOOLS AND METHODS USED IN MAKING THE FLYING-BOAT FITTING

AUTOMOTIVE CONSTRUCTION

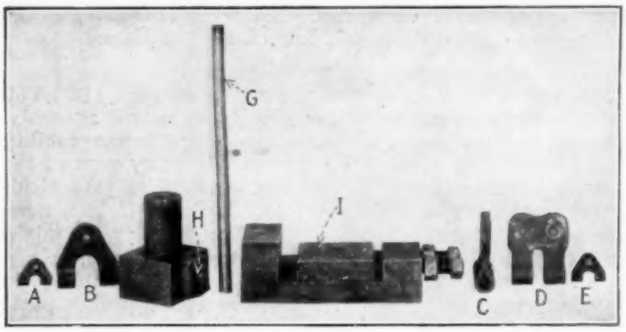


FIG. 19. A UNIVERSAL PUNCH AND DIE FOR BENDING WIRE TERMINALS

ing hinges where the location of the holes differ, the jig plate *E* can be removed and either of the ones *C* and *D* substituted therefor. The hinge is locked in the jig by a cam operated by the lever *G*.

A device for forming eyes on wire is shown in Fig. 22 and a wire with one of the eyes formed may be seen at *A*. Before the eye is formed a short spiral coil of wire *B* is slipped over the wire and after the eye is formed is pushed over the two adjacent parts of the wire to hold them together, thus preventing the eye from opening under stress. Fig. 23 shows an assembly of the device in which *A* is the pin around which the eye is formed. *B* is the pin that forms the eye as the lever *C* to which it is attached, is swung around to the right. As the lever *C* approaches its stopping position it strikes the end of the small pivoted lever *D*. This brings the pin *E*, at its other end, in contact with the wire on one side of the eye and at the same time the pin *B* comes against the other side. A slight further motion of the lever pinches the two parts of the wire together and completes the formation of the eye. For forming an eye in the other end of the wire the eye already formed is placed over one of the hooks *H* and the former operation repeated. The block *G* carrying the hooks *H*, is adjustable along the bar *J* and can be clamped in position by the thumb-screw *K*, being insured from slipping by the engagement of the pawl *L* in the ratchet teeth *M*. Wire is gripped in vise *N*, as shown, to prevent it from slipping while forming the first eye, as the lever *C* acting as a wiper would pull the wire around pin *A* and thus make the eye irregular in shape. It will be readily understood that eyes can be formed at any required center distance within the range of the device. It will be noticed that the three hooks *H* are staggered.

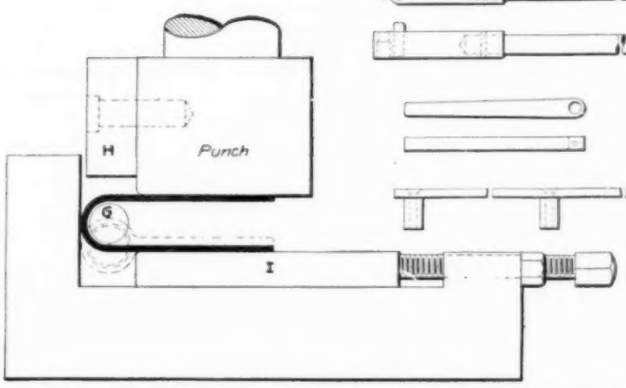


FIG. 20. DIAGRAM SHOWING ACTION OF PUNCH AND DIE SHOWN IN FIG. 19

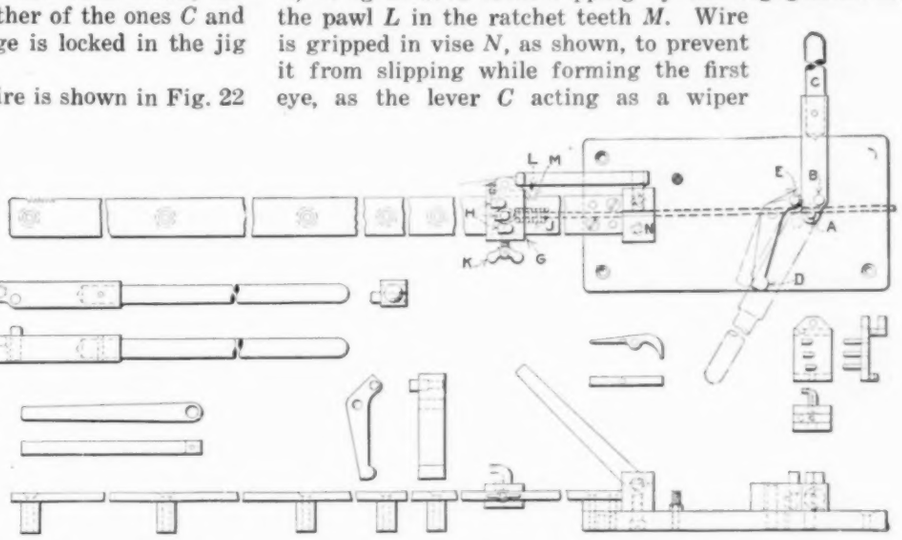


FIG. 23. ASSEMBLY AND DETAILS OF EYE-FORMING DEVICE

The reason for this is that by placing an eye over any one of the three hooks, the center distance between the eye on the hook and the one to be bent can be made within much closer limits than those which are already provided for in the pitch of the ratchet teeth.

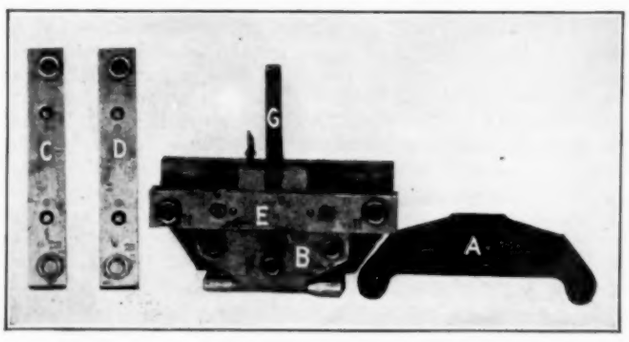


FIG. 21. A WING-BEAM HINGE AND DRILL JIG

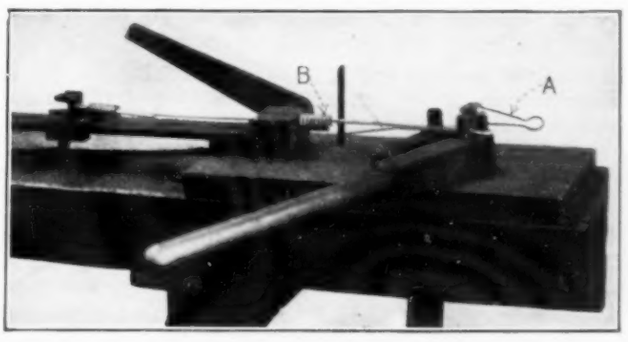


FIG. 22. DEVICE FOR FORMING EYES ON WIRE

Standardization and Interchangeability

The letters which follow give the experience of a number of well-known engineers in various lines on the subject of "Standardization and Interchangeability," as brought out by the article on page 1143, Vol. 50. The subject is of vital importance to those who are considering reduction carefully and from various angles:

I read the article on "Standardization and Interchangeability" on page 1143, Vol. 50, of the *American Machinist* with much interest. It covers so many points in manufacturing that it is difficult to comment except in a general way. The article states facts all the way through, but I believe that selective assembly can be reduced to a minimum, or practically eliminated by the proper setting of tolerances in making gages whenever the quantity of production is sufficient to warrant the expense.

As is stated in the article, I have known a thousand instances where specifications and tolerances on parts were out of all reason. In other words, no such close tolerances as demanded were at all necessary, but the engineer or draftsman establishing these tolerances was not familiar with shop practices.

GEORGE T. TRUNDLE, JR.,
Consulting Engineer.

We try to make all of our work interchangeable, but there are many parts where we find it necessary to make the limits less than 0.00025 in. and we find the only way to get the desired results is to do the final finishing by fitting the two together. Some people call this lapping, and this applies particularly to parts that should shove together without any shake.

Also, on our larger work, such as fitting the shafts into the gearing which go together in an awkward place and where it is impossible to do any driving, we find it necessary to fit them individually. For, while the hole may fit the standard plug, yet there are minute discrepancies through a length of 15 to 20 in. so as to make the shaft too tight for assembling.

In the cutting of gears and in the fitting of shafts, both have running, sliding or driving fits, and we experience no difficulty in making all these parts interchangeable, as outlined above. One of the greatest difficulties that we have to contend with and which the writer finds to be the same in many of the leading tool plants, is with the screws, bolts and nuts that we have to buy from manufacturers who make a specialty of this work. We do not have so much trouble with our screws and bolts as we inspect every one as it comes into our stock room, but all the trouble seems to be with the standard finished case-hardened nut. The various manufacturers make any number of excuses on account of the tap cutting a little large or free at first and then wearing a little small so that they demand a tolerance of at least 0.003 in. over and under. Anyone can readily see what this does to work where it is necessary for the nut to be a good fit.

We find it almost necessary to fit the nuts directly to the work in our lathe department and then leave them in place until they reach the assembly floor.

GEO. LANGEN,
General Superintendent of The Cincinnati Planer Co

I indorse heartily the article on page 1143, Vol. 50, of the *American Machinist*, and believe that if mechanical papers would devote more time to this sort of publicity on the foolish things that many shops are doing, that it would bring the matter more forcibly to the minds of the men higher up. This could be done in such a way that the practices referred to could be speedily corrected and the waste and loss of time and production materially reduced. This is a very important matter, particularly at this time when from all appearances we are to work fewer hours at the same or higher wages.

We are following the methods suggested almost exactly in our product. We have unit assemblies all as nearly alike as is necessary for the work in hand, simply leaving one or two intermediate parts to be fitted where slight variations are most likely to occur. We hope to see more articles dealing with this subject, and bringing the matter home to those guilty of wasteful practices.

W. W. BLAKEMAN,
Superintendent, The Blanchard Machine Co.

On the whole I agree with the article on page 1143, Vol. 50. It makes a pretty strong plea for selective assembly, and there is no doubt that this kind of interchangeability fills the bill in a great many places. The early part of the article brings out one side of the question as to agricultural machinery which is perfectly logical. Unless, however, there is some attempt at interchangeability, we might get a new piece which would not even go in a worn hole.

The strongest argument for strict interchangeability, in my judgment, is the loss of time in replacing broken parts if they require any fitting, or if the manufacture of the part is not such as to provide a fit with a very small amount of work. I often find it difficult to make a distinction between standardization and interchangeability, and of course we all know of many places where interchangeability is claimed when in reality it does not exist, never did exist and ought not to exist.

Much of the difficulties in regard to accuracy is due to a lack of understanding, both on the part of those who specify the material and those who make it. There is also a lack of understanding in regard to the necessity of adhering to whatever tolerances may be set, even though these be liberal in themselves.

If, for example, a tolerance of $\frac{1}{64}$ in. is permissible, it is quite evident that everything beyond this must be rejected, even though it might possibly function. Otherwise, the variations might be carried on almost indefinitely. It must be very evident that for every article there is a boundary line which should never be exceeded, and if the contract is entered into to keep within this line, it should certainly be done.

I am very glad the article in question was written, and I trust that it will not be misunderstood as being an argument against standardization and interchangeability, which I am sure was not the case, but only as pointing out some of the things to be considered on both sides of the question.

E. C. PECK,
General Superintendent, Cleveland Twist Drill Co.

The position taken in the article on page 1143, Vol. 50, is in accordance with our policy of standardization and interchangeable manufacturing. I agree that the unnecessary waste during the war must have been enormous, due to the endeavor on the part of some in authority to force on the manufacturer theoretical schemes of production requiring very close tolerances in machine operations that were not essential to the assembling or functioning of the product. H. H. EDGE.
General Works Manager, The Locomobile Co. of America.

The article on Standardization and Interchangeability covered the ground fully and almost anyone can apply the thoughts expressed therein to conditions which are common in his own experience.

I particularly recall the almost universal practice among machine-tool builders of squaring the shoulders of apron cross-shafts and similar pieces to fit the particular faced limits they are to run between. Here is an instance where the diameter of the shaft itself and the bearing it runs in are both accurately maintained to close limits, yet the length is crudely measured and the final assembly is one of fitting.

Try to imagine spot-facing the upper and lower seats for an elevating screw on a gear cutter, scraping them for finish and squareness by a gage, and at the same time gaging the distance between the seats so that a closely gaged collar to shoulder distance on the screw would fit as it should. LUCIEN I. YEOMANS,
Chief Engineer, Amalgamated Machinery Corp.

The British Eight-Inch Howitzer—III

(Concluded)

By I. WILLIAM CHUBB,
European Editor *American Machinist*

FOR testing the clearances the frame shown in Figs. 29 and 30 is used, the screw being dropped rear face down on a pin in the base and fixed in position by a pin in the roller axis pin hole. On a frame which can be swung over the screw is a series of three swinging arms with two templets fixed, one to each side of the frame. These together represent the breech opening. The templets are located by steady pins.

The obturator, Fig. 31, is a forging of steel and is turned in a lathe, a fairly generous allowance, say $\frac{3}{8}$ in. on the diameter, being left on account of the tendency of the hole to run when being bored. At least 1 in. is also left on the length. Following this the piece is heat-treated, oil-hardened and then bored in a gun-barrel drilling machine, being secured by four screws in a bell chuck with the stem at the back running in a steadyrest bored to suit. First a D-bit 0.91 in. in diameter is put through, having a longitudinal hole for lubricant, the cutting edge having grooves in order to break up the chips. It is followed with a double-fluted bit 0.92 in. in diameter, the flutes being straight, also having a hole for the lubricant. The limits on the hole are plus or minus 0.0025 in. Throughout the boring operation the spindle runs at about 220 r.p.m. and the feed is about 5 in. to the hour.

Countersinking, finish-turning, threading and recessing are ordinary machining operations, but in the recessing the stem is run in wooden blocks in a bearing and at the small end is pulled up against the faceplate by a clamp.

The cylindrical diameters are ground, but the mushroom head is turned and polished by emery in the lathe.

The key which is positioned from the start of thread is an integral part of the obturator and is formed in the usual way.

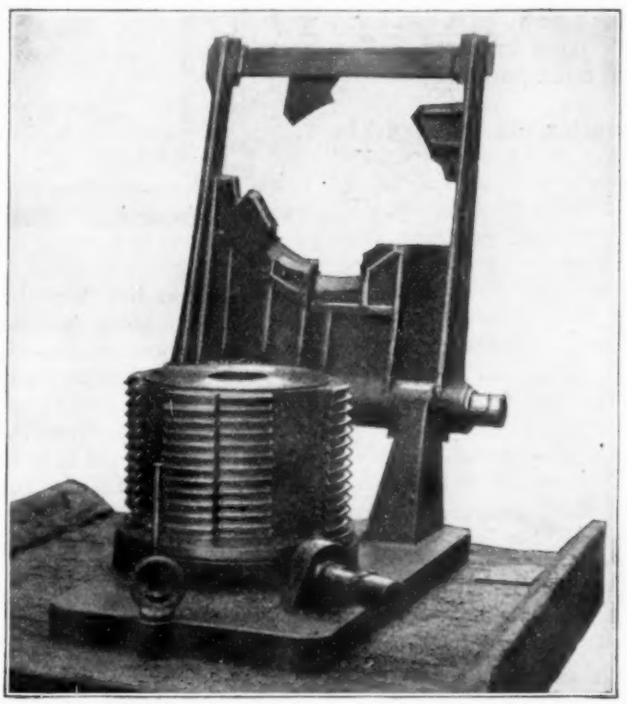


FIG. 29. FRAME FOR CHECKING SCREW CLEARANCES

The obturator spindle, Fig. 32, is for the most part an ordinary piece of machining, though this does not apply to the production of the long central hole and the chamber at the lock end. About $\frac{1}{2}$ in. is left all over to allow for the running of the drill; also $\frac{1}{2}$ in. on the length.

Boring is done in much the same type of machine as is used for the obturator. A D-bit with a lubricant hole is put through, leaving 0.002 in. to be taken out by a straight-fluted drill, each of these being about 3 ft. 6 in. long. The spindle runs at 1060 r.p.m., the feed being 5 in. to the hour. Stays are provided about 10 in. apart, each with a spring to bear on the flat of the D-drill to prevent vibration.

Finish-turning and threading are done from the bore and then cross-center lines on the primer hole end are scribed, being used subsequently when marking out the flats.

The primer chamber is produced on the lathe by a series of drills and reamers. The job is supported at the front end in a steadyrest and at the back by a split bushing in a chuck that is fastened to the faceplate. In this operation the process is to use a $\frac{5}{16}$-in. twist drill, the job rotating about 150 r.p.m., and the drill being fed by hand at the rate of about 3 in. a minute for a length of about 2.2 in. removing the majority of the metal. The drill is held in the lathe tailstock and the reamers are placed on the back center.

In the reaming process rape oil is used. To finish, sticks of wood of correct size are employed with emery powder. When the spindle leaves the lathe the hole is not touched by the fitter. Impressions, however, are taken, with sulphur and plumbago in the proportion of 3 to 1 melted in an ordinary plumber's ladle. A thin

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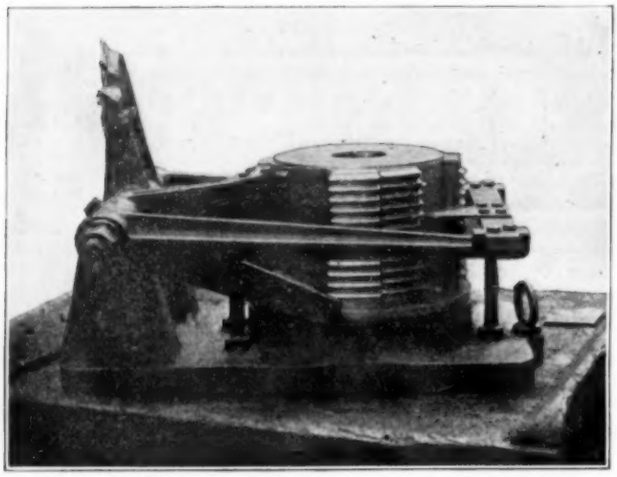

FIG. 30. FRAME FOR CHECKING SCREW CLEARANCES

wire bent up at the end to a foot forms a core and helps in withdrawing. The material sets in about half a minute. Gutta percha, used on other parts of the gun, is too coarse for this work.

In marking-off for slots, extractor, etc., care must be

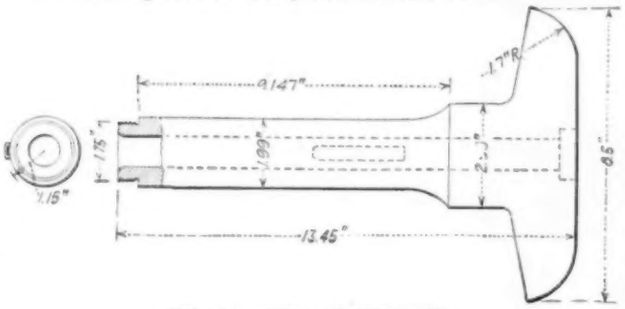

FIG. 31. THE OBTURATOR

taken that the extractor notch, flats, etc., come in correct position when the spindle, which has been previously adjusted to suit the striker in the lock, is screwed home. It may be explained that in this particular case the locks are not interchangeable, having been converted from an earlier pattern.

For milling slots the spindle is bolted on end and clamped against V-blocks and at one setting flats are cut and the radius for the securing block is machined, the work being to caliper and depth gage.

The hand lever, Fig. 33, is a steel forging machined all over. The forging is received with a straight arm, which is bent subsequently, the most interesting part of the manufacture being the production of the catch slot, of which sections are given. The hole 0.6 in. is reamed out, after the lever has been bent, by means of a ratchet working in the 1.9-in. recess to the hole in the long boss, and the undercut, section BB, can be cut out by dies guided by screw and driven from the same ratchet, the guide screw being held in place by small brass clips over the arm of the lever. The reaming is necessary owing to the closing in of the hole in the bending operation.

The lever catch, Fig. 34, is of steel, and the small tit left on the end is hollow-milled. To do this a centralizing jig is necessary. Usually the surfaces are milled complete first and the end section for handling purposes can be machined on the circular table. All the work is done in a vertical machine. Next holes are drilled and the slot is produced, this not being im-

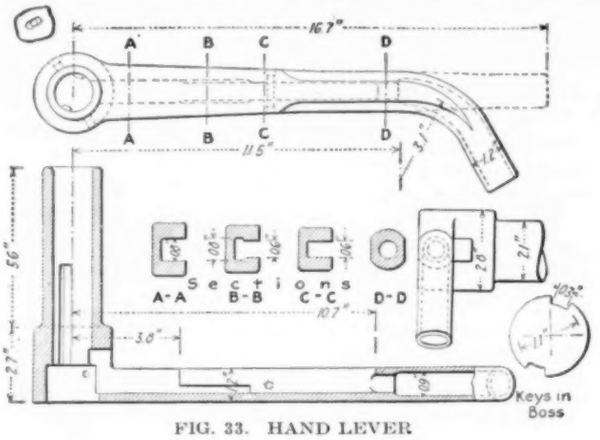

FIG. 33. HAND LEVER

portant, and the fitter then attends to the profile to see that the piece will pass the centralizing jig. The tit having been hollow-milled the metal left from this process is removed by slotting and the catch is fitted complete.

The catch plate is of steel machined all over. It can be partly machined in bars and afterward cut up as required and the various radii added. The pieces are let into a fitting jig, the cams being marked off from the jig which is used for drilling. The cam angles on this plate are important to the locking up and safety before firing the gun.

The hand-lever bearing is a manganese-bronze casting, all the surfaces of which are machined six operations being required.

As regards the bearing washer, Fig. 35, which is produced from gunmetal, the operations are of an ordinary character, including boring, turning, facing and milling the oil grooves, one on each side, a pantograph machine being used.

The safety shutter is a bronze casting and the work is mainly of a straightforward character.

The crankshaft, Fig. 36, is generally received as a rough steel drop-forging. The operations are merely such as are usual on a piece of this character.

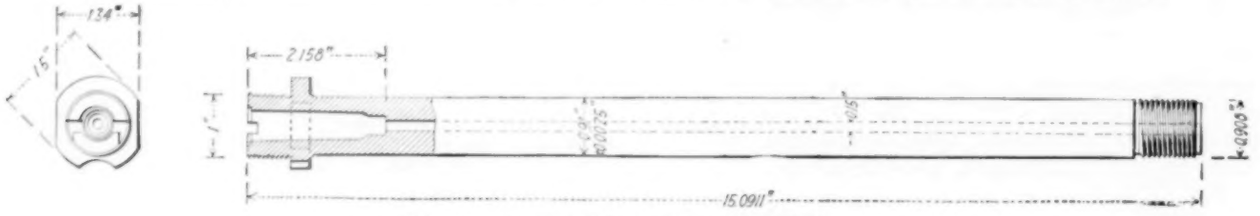

FIG. 32. OBTURATOR BUSH SPINDLE

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The production of the crosshead is a plain job, six or eight being parted off from a bar of phosphor bronze. The bar is first finish-turned, the pieces are then parted off in the lathe, the flats are milled in any convenient machine and before the production of the oil groove and final fitting the hole is drilled and reamed in a jig. The hole must be dead in the center of the crosshead.

The nut for the hand lever is cut from steel, and the only important point is that the cotter-pin hole determines the length from the crankshaft to the face of the nut; this is drilled in a jig, which also determines the position of the hole from the start of thread line.

The hinge pin, Fig. 37, is produced from a forging and is first rough-turned and bored at the end. It is then ground, the oil groove being cut in the lathe as a piece of screw cutting, the two ends being joined by a straight groove for which the lathe carriage is run across with a tool in the slide rest. After the necessary fitting work the cotter-pin hole is drilled at the end.

The cam, Fig. 38, which rotates the breech screw, is made from a drop-forging. The bottom and ends are milled and sized, then the profile is marked out. The plan view is profiled by a slotting machine, except the internal radius, which does not go straight down. Next the 0.1-in. drop, shown at section AB, is milled to form as dotted in the end view. The cam passages, or grooves, are then cut in a vertical milling machine, the cam being fixed in a jig at the correct radius from the circular table. The holes in the jig base suit the centers of the various curves of which the grooves are formed.

The control arc is first milled at the top and bottom and when marked out for profile from a templet is milled to the line.

The plate-retaining breech screw is made from a flat steel bar and the operations are all ordinary machine work.

Finally as to the chief breech-mechanism details the actuating pin for the retaining plate is turned in a fixture having two holes at correct centers for the throw, and the groove, the only other important detail in the machining, is milled, similar to a bayonet lock.

A note may be added on the fitting of the chief components of the breech mechanism. As regards the screw the final operation includes chipping the smoke gaps; with chipping the radius to clear the control arc, letting the templet in the crosshead and pin holes and fitting the obturator pin and roller with cotter pin; cutting oil grooves; fitting up the lubrication generally; riveting; cutting clearances for the pin on the crankshaft; stripping the whole and then assembling, the screw being passed on to men working on the carrier.

As regards the carrier the fitters receive the screw complete with roller, crosshead and the plate retaining the breech screw. On the carrier they have already let

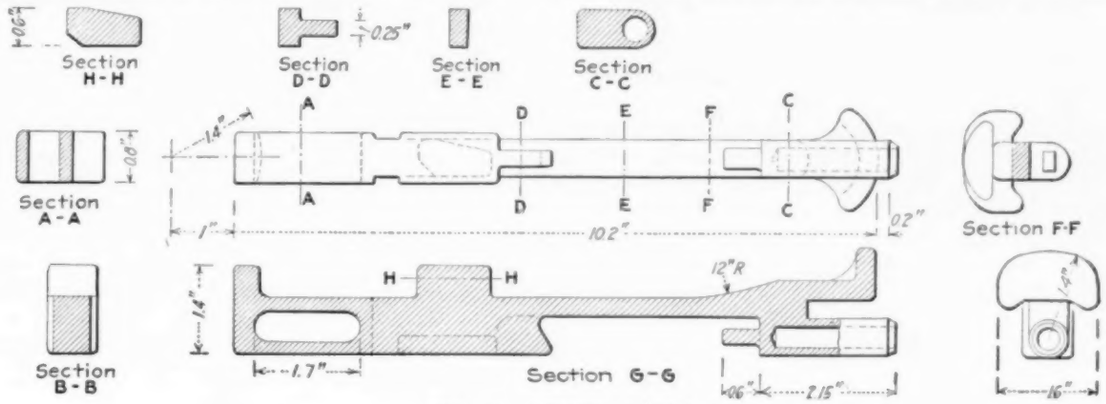

FIG. 34. LEVER CATCH

in the hand-lever bearing; and the lever and the crankshaft, already gaged up, are sent to them finished ready for assembly. The stops on the carrier to limit the travel of the breech-mechanism lever are adjusted to jig and then the breech screw is let on the spigot of the carrier, and if necessary, from distortion caused by the hardening process, the plate retaining the breech screw is adjusted. A couple of lines are then scribed on the screw to represent the travel; that is, the amount of turn of the screw in locking. The whole is then assembled complete and the lines thus scribed are tested by surface gage and, if necessary, adjustment is made on the back face of the hand lever.

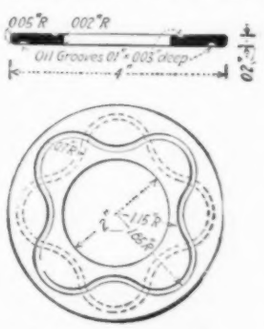

FIG. 35. BEARING WASHER

The carrier is rigged up and clamped down on the hinge face and tried by being swung to lines on the screw. The fitting frame has already passed over the latter, and anything further is taken off the breech opening.

It may be added that with the mechanism in position on the gun an angle gage is applied from the back face of the gun to the front face of the breech screw with the breech open in order to adjust the hinge so that the carrier and screw shall swing back far enough.

The government inspectors check the howitzer body at every stage from the cutting off of the first test piece. In the various tubes from 16 measurements upward on each are made of the bores and diameters, and it is usual for the government inspector to check five or six on each tube. After the building of the two A-tubes measurements are taken at the muzzle end and the breech end to insure that the inner A-tube is home in

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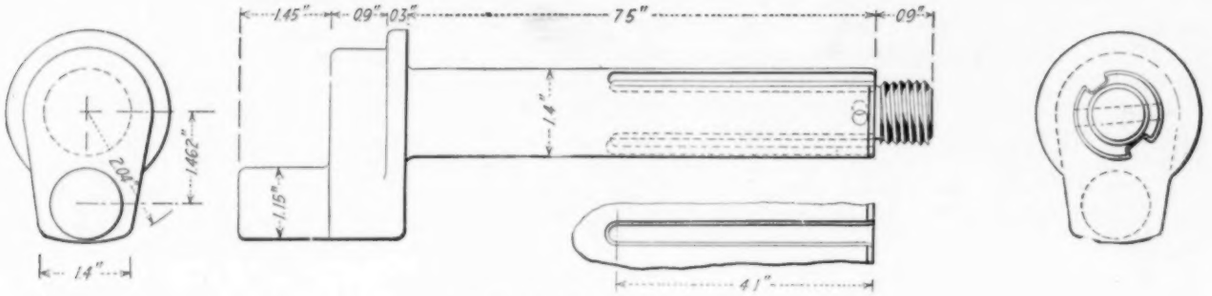


FIG. 36. CRANKSHAFT

its seating and the A-tube in the jacket, the same applying to the breech ring on the jacket. Measurements are taken inside the A-tube under the wire at the same places before and after wiring in order to show the contraction due to the wire and again after shrinking in order to show the effect of building.

After the finish-turning of the gun body the bore gage is passed through, and then, after the rifling, measurements are taken at intervals through bore and chamber, the intervals being determined by the positions of the shoulders. In order to discover flaws or defects gutta-percha impressions are taken, impressions being taken also at the rifling for gaging purposes. The protrusion of the inner A-tube at the muzzle end and the depth of breech opening are measured before proof and also after proof in order to determine whether any movement has taken place during proof. The obturator cone is tested before proof by a disk from 0.005 in. to 0.01 in. under size, the thickness of the disk being the same as the seating. The disk is covered in the usual way with marking, and the coned seating is scraped up by hand to insure a perfect gas check. The exterior of the gun is gaged at fixed points and a body gage is passed over, the measurements being taken again after proof to test for any expansion. The body gage embraces the bearing strips. A plug gage is placed in position in the piston hole of the breech ring and the corresponding hole in the body gage, this insuring interchangeability of carriage. Similarly a model mechanism is swung into the breech end of the howitzer to insure interchangeability of mechanism, clearances, etc., being adjusted to it.

As to the breech mechanism all the details are examined and checked separately by gages and then interchanged with the model mechanism assembled and swung into a model breech end in order to insure that all clearances are correct. The mechanism is then fitted with percussion locks which are tested for protrusion and for concentricity, the latter to insure that the blow takes place in the center of the cap.

As regards the breech screw the start of thread is important. From it inspectors gage to the front face of the screw in order to make sure that the metal there is not excessive, preventing closing when the obturator is in position. About 0.008 in. is left on the face to allow for setback of the threads after firing. As regards the cam it is important to see that during the rotation of the breech screw the pin does not catch and that all the weight comes on the roller. The vent axial is examined very carefully. The stem diameter is not very important, but the chamber is inspected

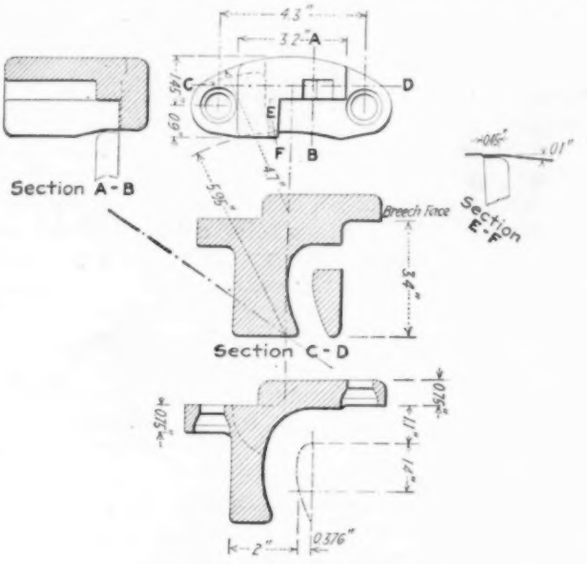


FIG. 38. ROTATING CAM

and impressions are taken to insure that no tool marks appear, as they would cause rejection, because on firing the adapter swells and would fill scores in the chamber, preventing the ejection of the adapter. Also the flash hole must be bored through from one end so that a perfectly free passage for the spark results. The only other point calling for mention is that the faces of the axial vent are checked by plate gages. The recess on the vent nut must be in line with the key on the vent stem.

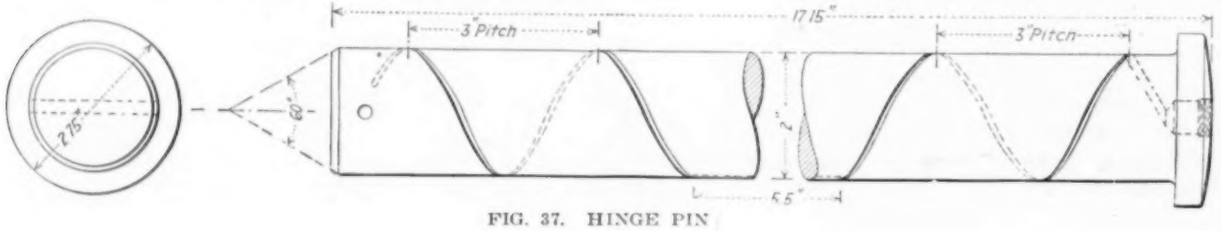


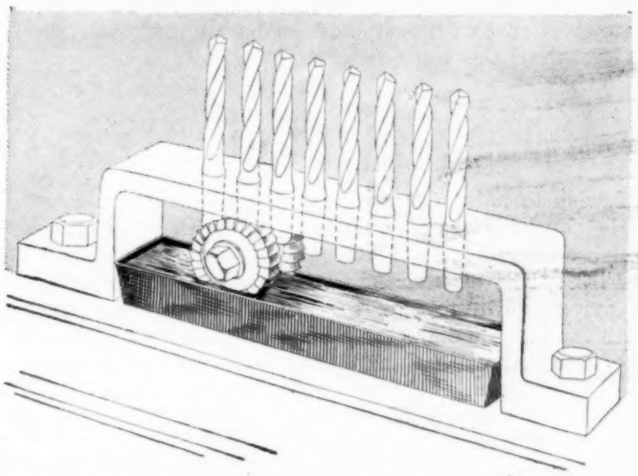
FIG. 37. HINGE PIN

A Kink in Cutter Lubrication

By Matthew Harris

The article published under the above title on page 995, Vol. 50, of the *American Machinist* reminds me that I first saw this method of lubricating cutters in the shop of a twist drill company about 1886.

The accompanying illustration shows the arrangement as used for milling the flats on the taper shanks of twist drills. A cast-iron bridge was bolted to the milling-machine table and in the top a row of holes was drilled and reamed to Morse taper. The drill shanks were put in these holes and the drills were tapped on the end with a soft hammer. This held them tight enough for the milling operation. The illustration shows the relative positions of the drill shanks, cutters and oil pan.



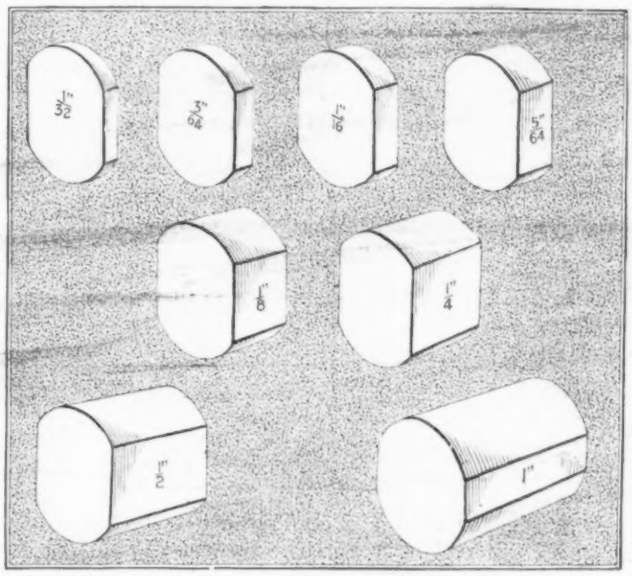
AUTOMATIC LUBRICATION OF MILLING CUTTERS

A Simple Set of Size Blocks

By A. R. Durant

Wishing to make a few size blocks of reasonable accuracy without a great amount of machine work and time spent in scraping, lapping, etc., I constructed a very satisfactory set of eight blocks in the following manner. The sizes were: $\frac{1}{32}$ in., $\frac{3}{64}$ in., $\frac{1}{16}$ in., $\frac{5}{64}$ in., $\frac{1}{8}$ in., $\frac{1}{4}$ in., $\frac{1}{2}$ in. and 1 in., from which any binary measurement in sixty-fourths up to two inches may be built up. The stock used was Stubbs steel rod $\frac{15}{16}$ in. in diameter. Eight pieces were cut off in the lathe approximately 0.008 in. thicker than the finished sizes, the end of the rod being faced off with the lathe tool before each piece was cut off.

Next, all but the 1-in. size were placed face to face in a shaping-machine vise and a flat about $\frac{11}{16}$ in. wide planed on both sides as shown in the cut. This gives each an oblong appearance with curved ends. The 1-in. block was machined in the same manner with flats but $\frac{5}{16}$ in. wide. After drawfiling the parallel sides of the thicker blocks, their size was stamped thereon with small steel figures while the thinner pieces were more deeply stamped on their faced surfaces.



A SET OF SIZE BLOCKS

The hardening was now done, using oil for the smaller sizes, to avoid warping. After polishing, each was tempered to a light straw color to relieve any hardening strains.

Grinding the blocks on both sides, using a surface-grinding machine equipped with a magnetic chuck, completed the job.

Starting every piece with the faced side down and taking light cuts they were brought to within a few ten-thousandths of the stamped sizes and no lapping was required.

Accurate Drilling Without a Jig

By Donald A. Hampson

In the manufacture of the "press button" knife there is followed a drilling plan that is 100 per cent. efficient. Like all pocket knives, this one has a hole through the shank of the blade for the pin on which the blade hinges. The hole is small and it must be a certain dis-

tance from other working surfaces on the blade. Everyone is aware of the loss resulting from chips clogging against locating surfaces of drill jigs. When the piece is not more than $\frac{1}{16}$ in. thick and a small drill must be accurately guided, it is apparent that more than usual care must be exercised to insure good work, and even then the progress will be slow.

The plan that has been worked out in this particular case begins with the forging of the blade and requires no jig and guide for drilling other than the hand. The die for the hammer that finishes the blade is fitted with a cone-shaped pin projecting just enough above the flat surface to make a countersunk impression at the proper spot on the blade. This is located as accurately as the die itself and being of the full lip size of the drill, no

ACCURATE DRILLING WITHOUT A JIG

better guide for accurate drilling could be provided. By use of the rest shown in the sketch, all chip trouble is avoided. This rest is simply a plate with four pins rising from the surface and having the tops ground off level. The pins are high enough to allow ample finger room and the operator holds the blades in his left hand while drilling. The ends of the pins, upon which the blade rests while being drilled are so small that there would be little tendency for chips to lodge there in any case, but there is no opportunity for chips to get to them for the reason that all chips that do not go through the hole where the drill is withdrawn, are lifted off with the blade when the latter is tossed into the box. Automatic lubrication is supplied and this tends to wash off any chips that might lodge on the pins.

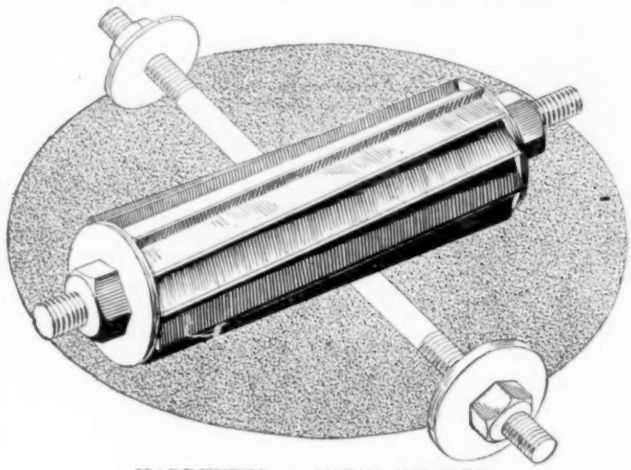
Kink in Hardening Shell Reamers

BY M. H. POTTER

Such pieces as bushings, hobs, shell reamers, etc., that are liable to warp or crack in hardening should be placed upon a holder as shown in the sketch.

The holder may be an old bolt or other piece of iron somewhat smaller in diameter than the bore of the piece to be hardened. It should be threaded for some distance farther than the length of the work and fitted with two nuts and washers, one of the nuts being loose enough to be spun into place with the fingers.

This bolt with the inner nut and washer in place should be held in a vise near the heating furnace, with the second washer and nut lying near where the operator can grab them quick. At the proper time he



HARDENING A SHELL REAMER

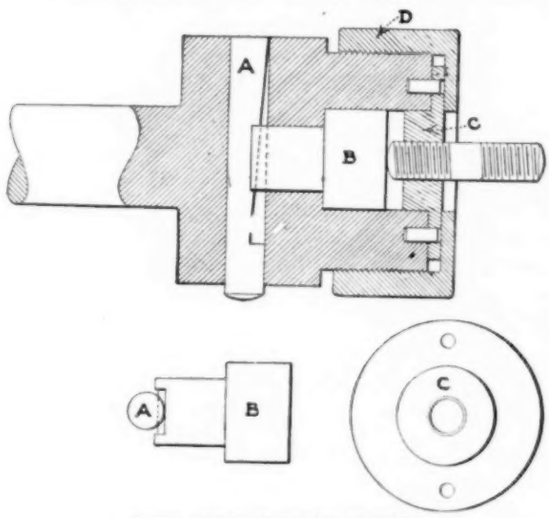
removes the work from the fire, sets it over the bolt, puts on the washer and nut and spins the latter to place, when the work is ready for quenching. Little, if any, water will reach the inside of the bore under these conditions until the work is practically cold.

Chuck for Nipples and Studs

BY JOHN C. WELLS

I wish to point out an improvement for the efficient little chuck described on page 79, by C. W. Putnam, which occurred to me while making one of them.

First: The circular key *A* is so made that when it is driven down to lock the stud the top comes flush with the outside diameter. Second: The space between the threaded plate *C* and the plunger *B* is less than



STUD AND NIPPLE CHUCK

the depth of the taper on the key *A;* the latter cannot then fall out either way, and the inserted piece is unnecessary. Third: When changing screwplates *C* no screwdriver is required—just unscrew the knurled cap *D* by hand, pull out the screwplate and insert one of the required size. The pegs prevent it from turning and the cap keeps it from pulling out. The key and plunger should be case-hardened.

The Government and Foreign Credits*

By E. E. PRATT
Vice President, Overseas Products Corporation

The up-to-date credit man in the United States is a careful student of domestic business conditions. He has at his finger tips all the information that will affect credits, especially in those sections where his risks are located. This information, while it does not help to determine the individual credit risk, does assist in determining the general credit conditions in a district and may indicate whether credit is to be freely extended or whether it is to be restricted. Information of this kind is hard to obtain with reference to foreign countries, but it is exactly the kind of information that the Government, by reason of its world-wide organization, is better prepared to collect than any private agency.

IF WE may judge by the number of governmental bodies that are concerned with and that function in some way or other in regard to foreign trade, we must conclude that our Federal Government is much interested. The size and diversity of this machinery and its world-wide distribution naturally gives rise to the query, "What assistance may the Government give exporters in selecting safe foreign credit risks?" Possibly I may be permitted to slightly modify the topic by substituting the word "determining" for the word "selecting"; because, as every good credit man knows, the selection of the risk is only the initial and even the simplest part of his job. The difficult part comes in keeping in touch with the risks, in making them better and safer risks, and in protecting them as far as possible from the dangers that are discerned only by those of greatest vision.

Perhaps it may not be out of place to review briefly the general scope of the existing Governmental agencies concerned with foreign trade. The most important agency is the Department of Commerce, and especially the Bureau of Foreign and Domestic Commerce. The Bureau maintains a considerable field staff, including several commercial attachés, stationed at the important embassies and legations; commercial agents, special agents and trade commissioners who travel from place to place usually engaged on specific missions of investigation. The Bureau also maintains a limited number of correspondents in certain places. The Washington offices are well equipped with a large and efficient staff, the chief function of which is to distribute this information. The branch-office service of the Bureau brings the facilities of the organization into every large commercial center. As an organization for collecting and distributing information with reference to foreign trade, we may safely say that the Bureau of Foreign and Domestic Commerce is not rivaled. The Bureau of Standards of the Department of Commerce is just beginning to realize its opportunities in developing foreign trade. It is now engaged in standardizing merchandise and certificating merchandise for export. If properly developed the Bureau can be of great service to our foreign trade.

Department of State

The Department of State, through the consular service, has a world-wide organization. Every commercial city of any importance, and many of small importance, have their consuls-general, their consuls and their consular agents. This body of almost 400 men is constantly engaged in collecting information about foreign trade, much of which is published in "Commerce Reports" of the Bureau of Foreign and Domestic Commerce.

A department of our Government comparatively little known in reference to foreign trade, is the Department of Agriculture and more particularly the Bureau of Markets. This Bureau has a constantly growing budget, and consequently a continuously growing staff is employed in investigating and studying foreign markets for American agricultural products of all kinds. It has a large field staff, a well-organized office in Washington and excellent methods of distributing information in the United States.

There are many other Government agencies that come in contact with our foreign trade. The Federal Trade Commission, now charged with the administration of the Webb-Pomerene Act, exercises limited powers. The Tariff Commission has important foreign investigations to make and policies to recommend.

It has long been the policy, and a proper one, I believe, of the Department of State, to refuse to give business concerns or private individuals any information as to the financial standing or credit rating of business houses abroad. Consequently all consular and diplomatic officers are instructed to refuse such information to all inquirers. Other departments have followed this precedent and refused to give out what is strictly credit information particularly of a financial character. The Bureau of Foreign and Domestic Commerce has adopted a similar policy.

Nevertheless, there is a very considerable body of information with reference to foreign credit risks, which is not today obtainable from any source, which the Government could easily obtain and make available to the business public. There is available through the banks, through the commercial agencies, through the coöperative credit organizations, and through ledger experience, ample information with reference to the financial position of most foreign concerns. But such information is only a part of the story that the credit man dealing in foreign risks desires to have at his command. As a matter of fact, mere financial information is often misleading in the case of foreign business concerns.

Bureau of Foreign and Domestic Commerce

Another very concrete way in which the Government could assist exporters in determining credit risks, would be to establish, preferably in the Bureau of Foreign and Domestic Commerce, a clearing house for credit information.

The Bureau of Foreign and Domestic Commerce could be of very considerable assistance to American exporters by registering attorneys resident abroad who could be relied upon to handle legal matters for American concerns. In most foreign markets there are attorneys, even American-born lawyers, who would be available for this purpose. The Bureau would perform a real service to the exporting community by keeping a carefully prepared list of such lawyers and others, together with references, fees charged, cable address and other pertinent facts. The exporter, who gets into a controversy with a customer abroad, would then be able to find quickly a responsible attorney about whom there would be a certain amount of information, and who would undertake his case at least with a sympathetic point of view.

A strict interpretation of the term 'credit risks" would not usually include reference to foreign investments. This is a phase of credit information, however, which will be increasingly valuable in the United States from this time onward. Our changed position in world finance from a debtor to a creditor nation makes it absolutely necessary that the American investor should invest abroad very large sums of money. In order to do so intelligently, he will have to have the fullest possible information with reference to foreign investments. It might be suggested therefore that the Bureau of Foreign and Domestic Commerce collate all the available information with reference to foreign investments.

Aside from such specific information as the Government might be able to collect with reference to individual credit

*From an address delivered at the Sixth National Foreign Trade Convention, Chicago, Ill., Apr. 25, 1919.

risks, there is a very large body of general information regarding market conditions in foreign countries that might be collected with special reference to the general credit situation. If all of our consular representatives abroad were required to make weekly reports by mail or cable with reference to crops, financial conditions, special factors affecting business, proposed tariffs, new taxes and other matters of a similar kind, the export credit man would have at his disposal information that would be invaluable to him in extending his credits abroad.

I hope that I may be permitted to enlarge briefly upon another phase of the assistance that the Government may give exporters with reference to the position of credit risks abroad. I refer particlarly to the foreign policy of our Government, which at the present moment underlies every phase of our foreign credit situation. There probably never was a time in the history of our foreign trade when Government policies were of such tremendous importance as they are at the present moment, in determining the extension of credit by the individual exporter and for that matter in guiding his whole business policy.

Disturbed Conditions Abroad

The disturbed conditions in Mexico, which have ruined one of the very best export markets of the United States, are traced by many to our shifting and halting policy with reference to that country. Our large investments in Mexico have been ruined and endangered by the unwillingness of our Government to protect the interests of our citizens in Mexico. Trade with Mexico has come almost to a standstill, and is conducted at the moment only with the greatest difficulty. The extension of credit in Mexico at the present moment is little better than a gamble.

Conditions in Russia have followed much the same general course as conditions in Mexico. The policy of the allied governments with reference to Russia, which has been to a very considerable degree guided by our own Government, has also been indefinite, shifting and halting. We have sent our armies into Russia in sufficient number to stir up the enmity of the entire public, but in insufficient number to accomplish any real results. Our trade with that wonderful country of magnificent natural resources, which would have been and which I hope will again be one of our very best markets, is now practically non-existent.

The foreign policy of the United States has in recent years seen some extraordinary contracts. In the case of Mexico, although American property and American lives were sacrificed in the mêlée of revolutions and counter revolutions we have refused to interfere in the internal affairs of that republic. On the other hand we have interfered in the internal affairs of the Dominican Republic and the Republic of Haiti, where American lives and American property were endangered. We have not only interfered, but we have set up governments that are practically colonial administrations. We are superintending the finances of those countries. We are even policing them. Just exactly why we should interfere in the affairs of the Dominican Republic and Haiti, and just exactly why we should take over and supervise these governments, and why we should omit to do so in the case of other disturbed areas even on the American continent, is a question which our unannounced foreign policy does not comprehend.

Stop for a moment to examine the map of the world, and no one can fail to be impressed by the very large areas that are today in a disturbed and unstable condition. No one can fail to be impressed with the spread of such infectious disturbances. He is a brave exporter who today is willing to send his merchandise into Central Europe, unless he has first received payment. The same is true of all of Russia, Siberia, and Mexico. We hear constant rumors about revolutions and disturbances in other parts of the world, as for example in Italy and Argentina. This is the most important aspect of the credit situation which we must take into consideration at the present time. It is a situation in which our Government can be of the greatest assistance in selecting and in determining our credit risks. We must look to the Government of the United States for a consistent policy with reference to the protection of American interests abroad.

Who Devised the Projection Lantern Method of Thread Measurement?

London, May 23, 1918.

The Editor, *American Machinist*,
6 Bouverie Street, E.C.

Dear Sir:

I have had recently called to my attention an article by members of the Bureau of Standards' Staff, entitled "Projection Lanterns for Thread Measurement," published in the European and Colonial edition of the *American Machinist*, Saturday, Jan. 11, 1919. (American Edition, page 805, vol. 49.)

I wish to enter a strong protest that no reference in this article is made to the work done at the National Physical Laboratory, England, in this connection. Late in 1915 the members of the Metrology Staff of the National Physical Laboratory commenced investigations into projection of gages (screw gages and others), with a view to developing suitable apparatus. We were successful, and at the time when the Americans entered into the war, one machine termed by us the "horizontal projection machine" was not only fully developed, but was being manufactured in considerable numbers.

We had another form of machine designed with particular regard to the projection of screw gages which could be operated entirely by one person and on which complete measurements could be made of the screw gage. This machine we called the "vertical projection machine."

Members of the Bureau of Standards visited the National Physical Laboratory with the United States Commission after the United States of America entered into the war, and I personally demonstrated the use of the various machines to members of the Staff of the Bureau of Standards. A sample "horizontal projection machine," together with other screw-measuring apparatus and a description of the "vertical" type of projection machine was sent to America.

Many of the terms used in the article, such as "shadow projector," are names given by us to parts of the apparatus supplied, or described, to them.

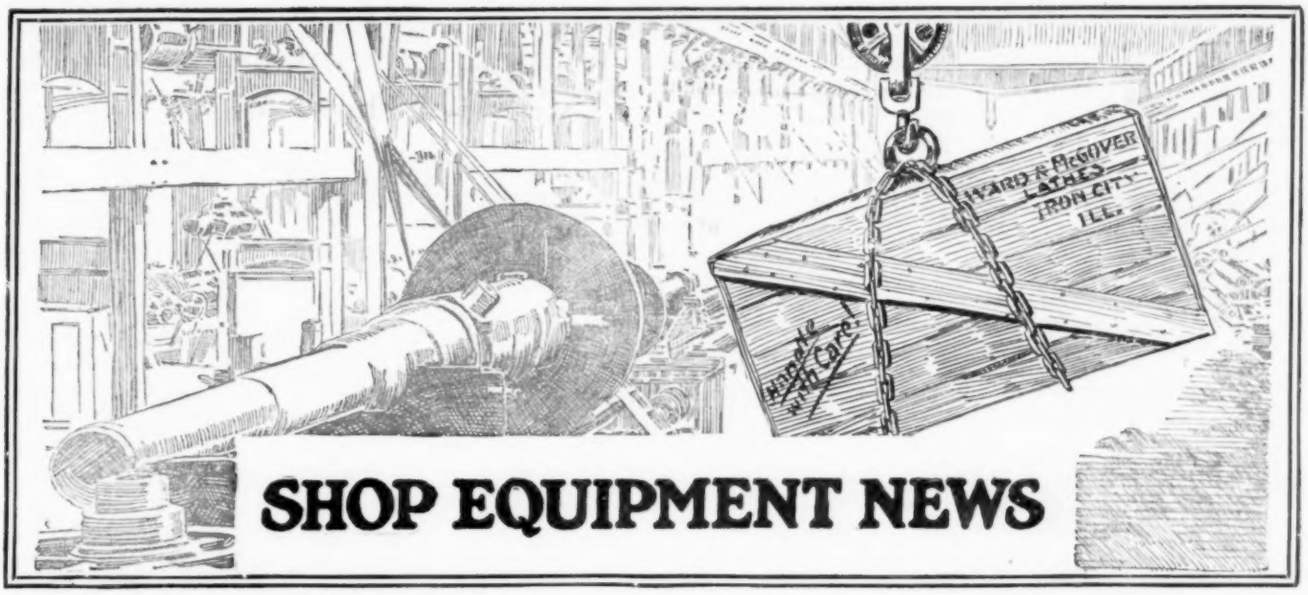
I do not think that the Bureau of Standards can claim to have developed this apparatus, although the particular illustration given is an apparatus arranged to give the ease of control which we had embodied in the "vertical projection machine," which they saw on their visit to England. At the time the "horizontal projection machine" was sent to America the "vertical projection machine" was not in the manufacturing stage, although one or two of the machines had been erected and were in use at the National Physical Laboratory; otherwise one of this type of machine would have been sent to America.

Yours faithfully,
(Signed) Bernard P. Dudding.
(Until recently a Senior Assistant at the National Physical Laboratory.)

Will Tell of Italian Markets for Industrial Machinery

Trade Commissioner W. C. Marshall has returned to this country after completing an investigation of Italian markets for industrial machinery and is planning to visit a number of eastern cities in order to confer with interested manufacturers and exporters. He will be at the District Office of the Bureau of Foreign and Domestic Commerce, 734 Customhouse, New York, from July 21 to Aug. 2; at the Chamber of Commerce in Providence, Aug. 4, 5 and 6; at the Chamber of Commerce in Worcester, Aug. 11 and 12; at the District Office, 1801 Customhouse, Boston, Aug. 7, 8 and 9; at the Coöperative Office, Philadelphia Chamber of Commerce, Aug. 18 and 19.

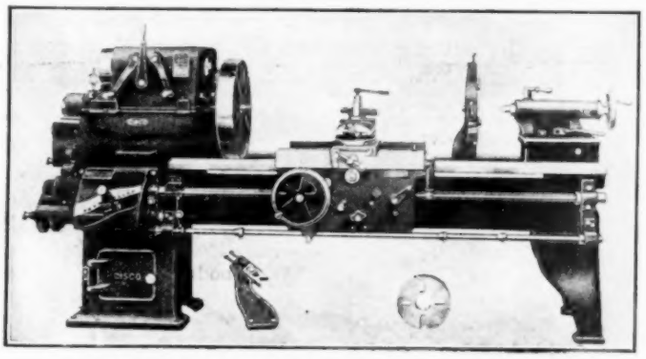
It is suggested that interested manufacturers of papermaking, textile, printing, shipyard, sugar, rope-making, hoisting and conveying, refrigerating, and woodworking machinery and machine tools communicate directly with the offices mentioned in order to arrange interviews.



SHOP EQUIPMENT NEWS

Cisco Geared-Head Lathes

The Cisco Machine Tool Co., Cincinnati, Ohio, has recently placed on the market a line of geared-head lathes made in 14-, 16-, 18- and 24-in. sizes. These machines are made for either belt or motor drive and are arranged to give 10 speeds with motor drive and 20



CISCO GEARED-HEAD LATHE ARRANGED FOR BELT DRIVE

with a double-friction countershaft. The gears are all operated by four levers or handles including the back-gear lever, a pull-pin in the face gear being used to run directly from a spindle when the back gears are thrown out. In applying the motor to the lathe, a plate is placed on top of the regular geared head, with a bracket on the plate for the intermediate gear stud. The horse-powers recommended for the 14-, 16-, 18- and 24-in. sizes are 2½, 3, 5 and 7½ respectively.

Chapin & Baker Toolholders

Two forms of a toolholder manufactured by the Chapin & Baker Manufacturing Co., 143 Edison St., Syracuse, N. Y., are illustrated, Fig. 1 showing the turning toolholder and Fig. 2 that used for roughing out bevel gear teeth. In each tool a high-speed-steel formed cutter with three drilled holes is held by a through bolt in the end of an alloy-steel shank. The holes permit of making the maximum use of the cutter as it can be fed out as the cutting edge is ground away. In the shaping-machine tool, Fig. 2, the small setscrew in the fork is for adjustment and the larger

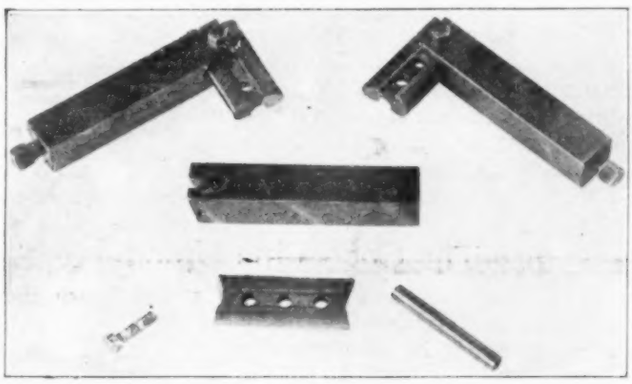


FIG. 1. CHAPIN & BAKER TURNING TOOLHOLDER

one, in the recess, for taking up any play that may appear between cutter and holder. The blades have four cutting edges and are formed to any required angle. The turning toolholder differs from the other in having a sliding pin within the holder which is held against the back of the cutter by the square-head setscrew shown in the figure, thus locking it firmly in place. The cutter has four cutting edges and thus reduces the number of trips to the crib for regrinding.

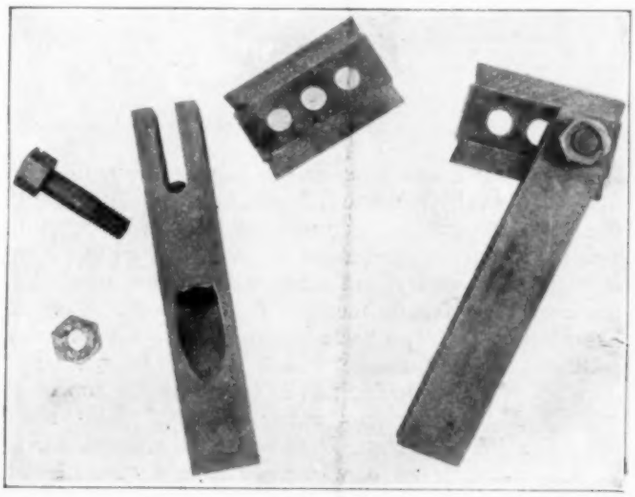


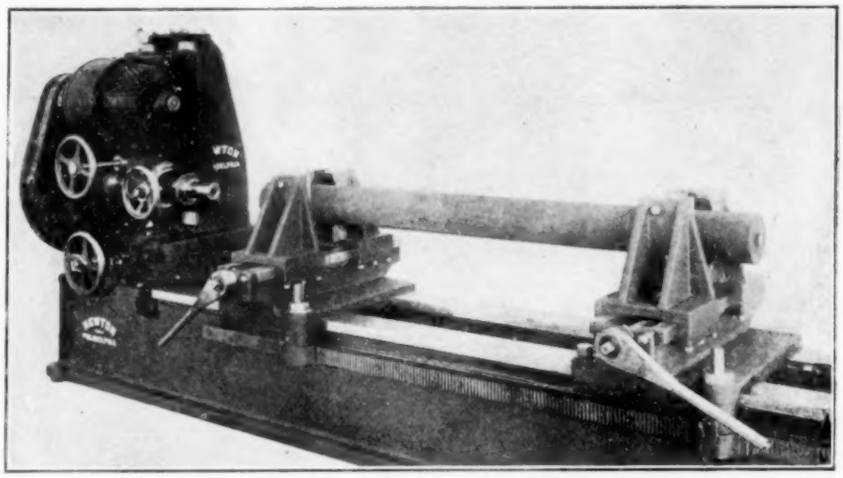
FIG. 2. TOOLHOLDER FOR ROUGHING BEVEL GEAR TEETH IN SHAPING MACHINE

Newton Centering Machine

The new centering machine illustrated is a recent development of the Newton Machine Tool Works, Inc., 23rd and Vine Sts., Philadelphia, Penn., and is intended for the purpose of centering rough and irregular forgings. The machine is equipped with two universal centering vises of the interlocking type, the jaws being adjustable by means of a screw. The vises will hold rounds from 2 to 12 in. in diameter.

The vises can be placed in any position on the bed desired, and are moved back and forth by means of a rack-and-pinion mechanism. The spindle runs in bronze bushed bearings and is made of forged steel 3 in. in diameter.

The spindle has cross and vertical feeds, 4 in. in each direction, and a longitudinal adjustment of 8 in. of hand feed. The machine is driven by a direct-connected motor through a bronze driving gear. The motor is mounted on the front of the headstock, this location giving a very direct drive. All sliding parts are maintained in position by means of taper shoes, these being provided with a means of adjustment for taking up wear.

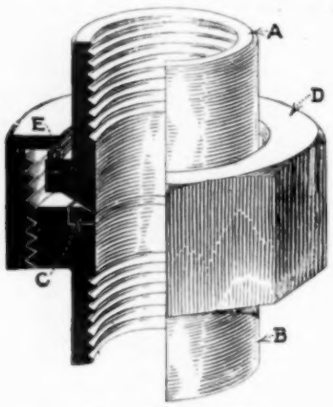


NEWTON CENTERING MACHINE FOR HEAVY FORGINGS

Diameter of spindle, 3 in.; in-and-out adjustment of spindle, 8 in.; vertical adjustment of spindle, 4 in.; cross adjustment of spindle, 4 in.; length of base, 16 ft.; width of base, 22 in.; distance from center of vise to top of base, 15½ in.; maximum distance from center of spindle to top of base, 17½ in.; minimum distance from center of spindle to top of base, 13½ in.

The Codd Pipe Union

The Codd Tank and Specialty Co., 117 South Hanover St., Baltimore, Md., is making the four-seated pipe coupling shown in the illustration. The union consists of five parts, a male and a female section threading



CODD PIPE UNION

on the ends of the pipes to be joined, a coupling nut and two washers made of soft metal. One of the objects of the design is to prevent leakage by providing two seats in case of damage to one. The male member *A* and the washer *C* are machined to form a ball joint surface. The female member *B* is recessed to contain the washer *C*. The male member *A* is also provided with a recessed flange which holds the washer *E*. The lip of the coupling nut *D* bears on the top of the washer *E*. If for any reason the ball joint should leak, the joint between *D* and *E* will prevent leakage in the coupling as a whole. The use of soft-metal washers in contact with the hard metal of the main parts is intended to prevent corrosion and leakage.

The Windau 4-In-1 Lathe Toolholder

Fig. 1 shows the 4-in-1 lathe toolholder which is being put upon the market by the Windau Tool Co., 1565 East 17th St., Cleveland, Ohio. In Fig. 2 the various parts of the device are shown disassembled. The tool is locked, unlocked and indexed by a wrench. A screw adjustment with ¼-in. travel is provided to take up the wear on the cutting tools and the turret is ground to fit the shank seat. The shank is a drop-forging and

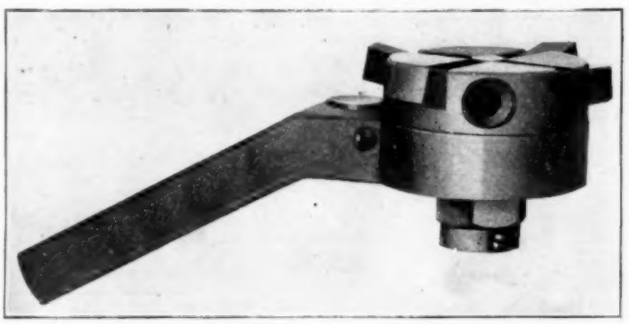


FIG. 1. WINDAU 4-IN-1 LATHE TOOLHOLDER

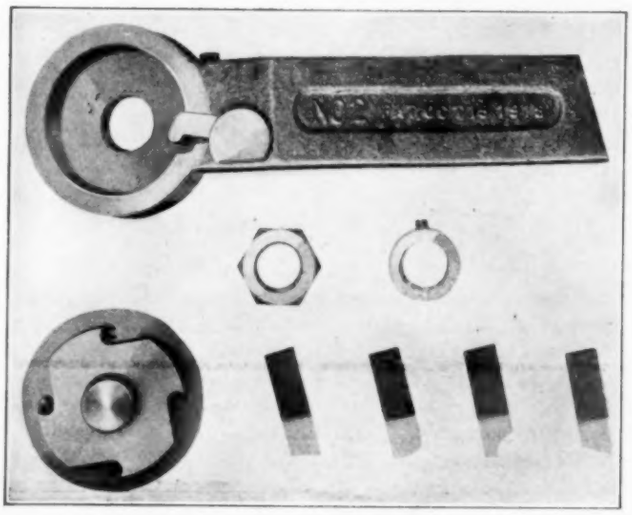


FIG. 2. WINDAU HOLDER DISASSEMBLED

the turret is made from cold-rolled steel, both parts being pack-hardened. The size of the shank is $\frac{5}{8}$ x $1\frac{1}{4}$ in. and the turret will take bits $\frac{3}{8}$ in. square. The tool is shipped with four blank high-speed bits and a wrench.

"Thor" Improved, Quick-Acting Hose Coupling

The Independent Pneumatic Tool Co., Chicago, Ill., has just announced a new quick-action hose coupling of the sliding-sleeve type. This coupling is universal, there being no male or female ends. There is a locking collar on each hose end, and when the coupling is made these locking collars or sliding sleeves work in opposite directions. It is said that they cannot be disengaged by coming in contact with rough surfaces but that they can be disconnected in the sleeve by a straight pull on the sliding sleeve at each end. It is not necessary to twist, as the jaws separate as soon as the locking shoulder moves back. The sliding sleeves are said to be heavy and unbreakable, while the operating spring is large and can be replaced if necessary. An L-shaped gasket is used, and when the coupling is connected it is held in place by air pressure. The gasket cannot be blown out when the coupling is disconnected, because of a projecting shoulder in the coupling. Ribs are provided for the coupling shank for using the new "Thor" hose clamp, which is also a recent addition to this company's line.

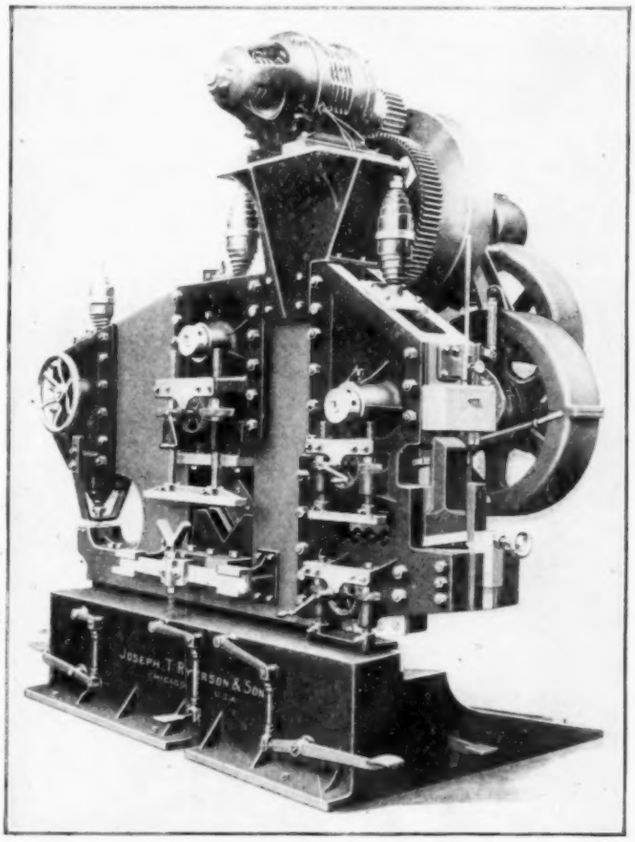
Ryerson Punching and Shearing Machine

Joseph T. Ryerson & Son, Chicago, Ill., has just brought out the punching and shearing machine illustrated which is for use on plates, bars, structural shapes, etc. The machine consists of three separate working positions, any one of which can be handled separately and entirely distinct from the others. These three positions will shear plates, bars or structural shapes and can also do the work of coping, notching, section cutting and punching without changing any tools or attachments. The machines are made in six sizes. The entire driving mechanism such as gears, clutches, flywheels and other parts is located on the rear of the press, leaving the operating side free from overhanging parts, a feature that is said to make for safety and rapidity of operation. The machine has a steel plate frame to insure strength and rigidity, the plates being pinned and bolted to the base castings. This construction is also used for securing the other cast pieces used in the make-up of the machine. The construction around the shear is such that plates of any length can be cut.

Separate three-jaw clutches are used for operating each of the sliding heads. The clutch for the punch is provided with a device to allow adjustment of the stroke as desired. The clutches for the slitting shear, bar cutter, and clipping and notching sections of the machine can be operated by either the hand or the foot, while the clutches for the punch and section cutters are foot operated.

Holddowns are provided for all types of work, and standard architectural jaws permit work on I-beams, channels, etc., The camshaft of the punch is provided with a handwheel, which allows the centering of the punch to the full length of the stroke. The shear for cutting round and square bars is located in the sliding head of the plate shear, and, depending upon the capacity of the machine, is equipped with a shear blade provided with three or four notches for cutting different sizes of bars.

The coping and notching portion consists of two solid crucible-steel cover plates and brackets jointed to form a jaw in which the lower coping and notching blades are mounted. The blocks are fastened to the sliding head by means of a wedge which permits of quick change of these blocks for either coping or notching work. The center sliding head is provided with a universal blade holder which permits the quick change of shear blades for cutting angles, channels, tees, I-beams or other sections. The movable shear blade of this portion is set loosely into the upper holder, and the stationary block is mounted in the lower shear block, both being held in place by means of a saddle and two adjusting wedges. The three sliding heads of the machine are provided with bronze gibs. The plung-



RYERSON PUNCHING AND SHEARING MACHINES

Made in six sizes; No. 1 having a capacity for plate up to $\frac{1}{4}$ in., bars up to 1 in. in diameter, coping and notching capacity up to 3-in. I-beams and punching capacity for holes up to $\frac{5}{8}$ in. in diameter in $\frac{5}{8}$-in. metal; No. 2 having a capacity for plate up to $\frac{3}{8}$ in., bars up to $1\frac{1}{4}$ in. in diameter, coping and notching capacity up to 6-in. I-beams and punching capacity for holes up to $\frac{1}{2}$ in. in diameter in $\frac{1}{2}$-in. metal; No. 3 having a capacity for plate up to $\frac{1}{2}$ in., bars up to $1\frac{1}{2}$ in. in diameter, coping and notching capacity up to 8-in. I-beams and punching capacity for holes up to $\frac{3}{4}$ in. in diameter in $\frac{3}{4}$-in. metal; No. 4 having a capacity for plate up to $\frac{3}{4}$ in., bars up to 2 in. in diameter, coping and notching capacity up to 10-in. I-beams and punching capacity for holes up to 1 in. in diameter in 1-in. metal; No. 5 having a capacity for plate up to 1 in., bars up to $2\frac{1}{2}$ in. in diameter, coping and notching capacity up to 15-in. I-beams and punching capacity for holes up to $1\frac{1}{4}$ in. in diameter in $1\frac{1}{4}$-in. metal; No. 6 having a capacity for plate up to $1\frac{1}{4}$ in., bars up to 3 in. in diameter, coping and notching capacity up to 15-in. I-beams and punching capacity for holes up to $1\frac{1}{2}$ in. in diameter in $1\frac{1}{2}$-in. metal. Horsepower required, from 1 to 3 for No. 1 machine, to 25 to 30 for No. 6 machine; approximate weights, 3000, 5500, 10,000, 18,500, 37,000 and 55,000 lb. respectively.

ers are operated by pitman rods and are counterbalanced by heavy coil springs that take the place of counterweights. The cover plate for each sliding head is tongued into the main frame of the machine to insure a good sliding surface for the plunger, and at the same time provide for easy removal when necessary. The machines can be furnished for either belt or motor drive, all drive gears and pinions with the exception of the motor pinions being of cast steel.

"Lumsden" Tool-Grinding Machine

Alfred Herbert, Ltd., 54 Dey St., New York City, has recently introduced into this country the "Lumsden" oscillating tool-grinding machine that is said to have a number of valuable features, chief among which are its large production, minimum amount of exertion on the part of the operator, a wheel oscillated by power,

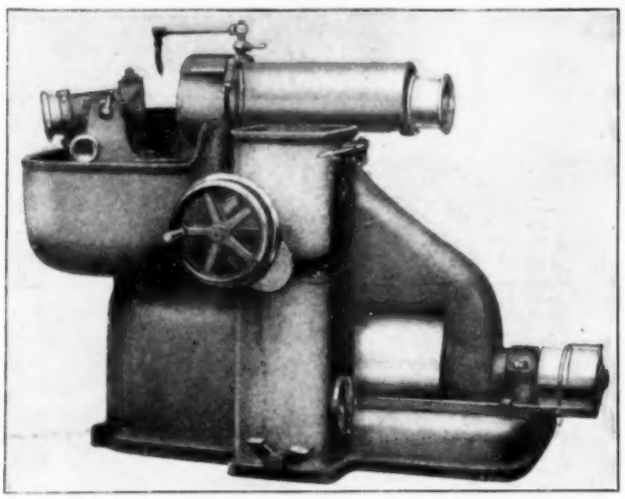


FIG. 1. "LUMSDEN" OSCILLATING TOOL-GRINDING MACHINE

Made in four sizes: No. 1, No. 2, No. 2a and No. 3 with respective specifications for the various parts as follows: Largest tool shank handled, 1⅝ x 2 in., 3 x 2 in., 3 x 2 in., 6 x 3 in.; smallest tool shank handled, ½ x ½ in., ¾ x ¾ in., ¾ x ¾ in., ¾ x ¾ in.; diameter of grinding wheel, 12 in., 14 in., 16 in., 16 in.; maximum stroke of wheel, 1¼ in., 1½ in., 1½ in., 2¼ in.; horsepower required, 3, 4, 4, 5; floor space, 80 x 64 in.; 86 x 60 in., 86 x 60 in., 93 x 60 in.; approximate net weight, 2912 lb., 3472 lb., 3490 lb., 4592 lb.

the elimination of a large amount of tool forging, tools ground from straight pieces of bar, dust and chips carried away by a powerful exhaust fan, all movements controlled from one operating position, tool in full view during the grinding process, all working parts dustproof, all high-speed shafts running on ball bearings, self-contained machine, attachment for grinding hollow curved top cutting faces and a forming attachment for shaping profile cutters. The machine is made in four sizes, Nos. 1, 2, 2a and 3, which take tools with shanks up to 1⅝ x 2 in., 3 x 2 in., 3 x 2 in. and 6 x 3 in. respectively. It is stated that practically all tools that can be made from straight pieces of bar up to ¾ x 1¼ in. can be shaped at the rate of 20 per hour while tools made from sections up to 1 x 1½ in. can be shaped at the rate of 12 per hour. Tools from sections larger than 1 x 1½ in. and 1½ x 2 in., when ground on the No. 2 or No. 3 machines respectively, should be roughly forged to shape before grinding.

The grinding wheel is mounted on an inverted pendulum frame which is oscillated by power on trunnion bearings in the base of the machine. This frame is actuated by a variable eccentric motion that regulates the amount of oscillation and is controlled by a single lever or handwheel. The grinding is done by the flat front face of the wheel which is conical cup shape, producing flat cutting faces, while the oscillating cut allows rapid grinding and insures uniform wear

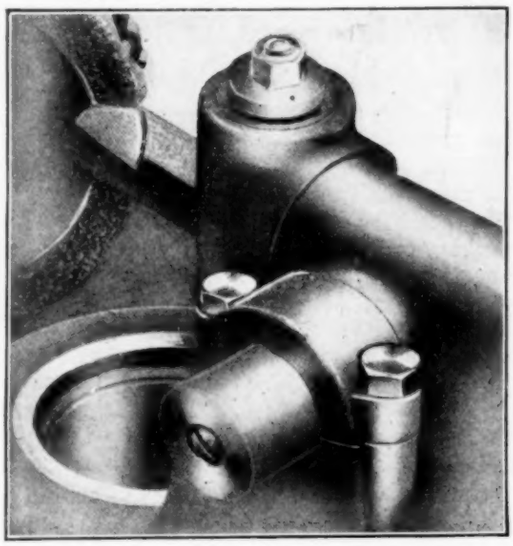


FIG. 2. GRINDING A DIAMOND-POINT ROUGHING TOOL

of the wheel. The bearings of the wheel spindle, self-contained countershaft, loose pulley and all shafts in the gear box except the eccentric shaft run on dustproof ball bearings. The oscillating frame is a box casting, and receives its motion from the variable eccentric arrangement located in the gear box. This eccentric is coupled to the swinging frame by a connecting-rod which is adjustably connected to the frame by a swivel joint. This adjustment provides for bringing the grinding wheel into correct relation to the tool and is controlled by a large handwheel on the front of the gear box.

The grinding wheel is also adjustable in the oscillating frame, this movement being controlled by another handwheel on the front of the gear box. It provides for the feed of the wheel to and from the work. Thus, by the two handwheels, located on the same axis, the wheel can be moved sideways, and toward or away from the work without stopping the oscillating movement. A lever for controlling the oscillation is close to the workman's hands while the pedal for starting or stopping the machine can be operated by the foot.

The toolholders on the No. 1 and 2 machines are universally adjustable for all tools other than those bent to a right angle. A fixture for holding this type of tool and also for holding tools while being ground on the base, is the only loose part used. The toolholder grips all square and rectangular tools by the two top corners and the base, and can rotate on its own axis,

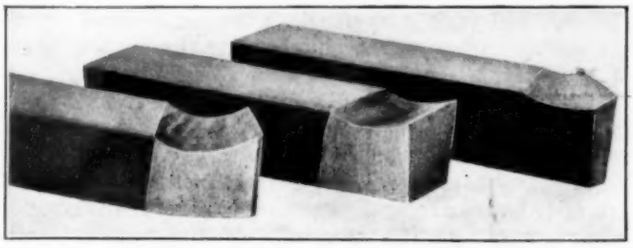


FIG. 3. TOOLS WITH CURVED TOP FACES

swivel on trunnions several degrees on either side of the horizontal and swing on a turntable on a vertical axis. This swing movement is made use of to bring both the sides and front faces in contact with the grinding wheel, and also for grinding a radius on the nose of the tool. The swiveling movement gives the rake or clearance angles required, while the rotation of the toolholder on its own axis enables the top and side faces to be ground. The toolholder is also adjustable sideways on both sides of the center to allow the

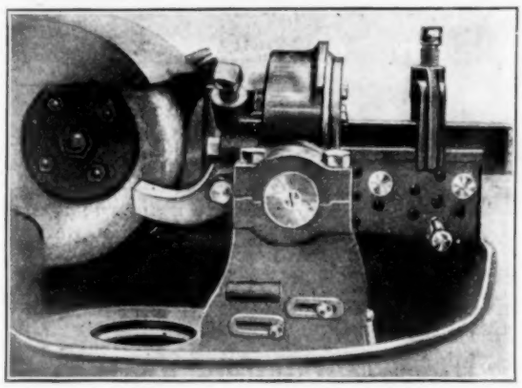


FIG. 4. TOOLHOLDER ON NO. 3 MACHINE WITH BENT TOOL IN POSITION

round nose of offset tools to be brought over the center of the vertical swinging movement. The toolholder on the No. 3 machine has all the adjustments of the smaller sizes, but is arranged for extra movements for accommodating the many and varied special tools used in machines for armor plate or other heavy work. Adjustable stops are provided by means of which duplicate tools can be shaped rapidly.

The curved face attachment consists of a swiveling toolholder fitted to a lever-operated slide, the whole being arranged to fit in the toolholder of the machine. By means of this attachment a curved face of any desired radius from that of the corner of the wheel to that of the circumference can be produced by adjusting the slide from the vertical to the horizontal.

Standard equipment includes one grinding wheel and mount, ball-bearing fan and exhaust duct, pump and connections, radius gage, fixture for bent tools, curved face attachment and chart. The No. 2a machine is regularly supplied with a form-grinding attachment which enables the large spade tools used in boring shells to be ground. A form-grinding attachment can be supplied for the No. 1 and No. 2 machines as an extra.

"Rollway" Lubricant Pump

The Michigan Machine Co., Detroit, Mich., has recently placed on the market the "Rollway" lubricant pump illustrated, which is for use in connection with machine tools for cutting-tool lubricants or force-feed lubrication, it being possible to pump either lubricant or oil as desired. Fig. 1 is an exterior view of the pump while Fig. 2 is a phantom view showing the construction. The principal working parts consist of two rollers which rotate eccentrically in the pump chamber. The motion is entirely rolling and the wear customary in ordinary pumps is said to be eliminated. It is claimed that this pump will do anything that either the geared, wing or centrifugal pump will accomplish, and that it will accomplish it at slower speeds. The inlet and outlet are

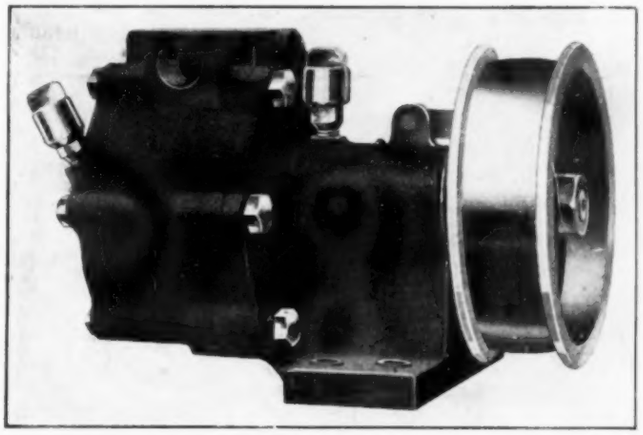


FIG. 1. THE "ROLLWAY" LUBRICANT PUMP

placed at the top of the pump so that it is self-priming. Another feature is that the tank from which the liquid is being pumped may be entirely emptied and the pump allowed to suck air, after which, if the tank is refilled, the pump will immediately start the flow again.

No relief valves or overflow piping are required. The discharge may be closed and the pump allowed to run without damage, this being made possible by the use of a spring placed in the rectangular slot in the inner roller which bears against the squared shaft. This spring operates only when the pressure on the pump is as great as the pressure required to compress the spring. When this pressure is reached the compression of the spring allows the rollers to come to the center of the pump where they continue to revolve. This spring also acts should any foreign matter such as steel chips, rags, etc., get into the pump. It is stated that should any of this foreign material stick, the spring will compress, allowing the roller to pass over the obstacle, which will be washed out on the next revolution of the roller.

The pump may be used in any position and either side may be used as the intake. Plain pumps may be used on reversing machines where no liquid is required when the machine is reversing, and when used in this manner the pumps can be reversed without harm and will again deliver the liquid when the proper direction of rotation is resumed. A pump equipped with reverse valves can be furnished where it is necessary to maintain a con-

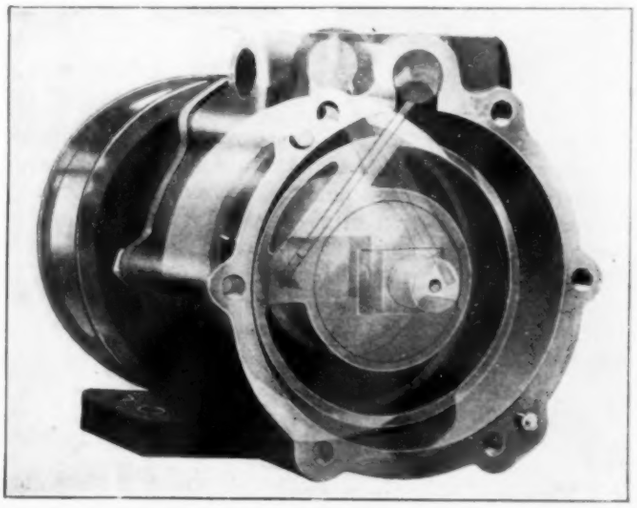
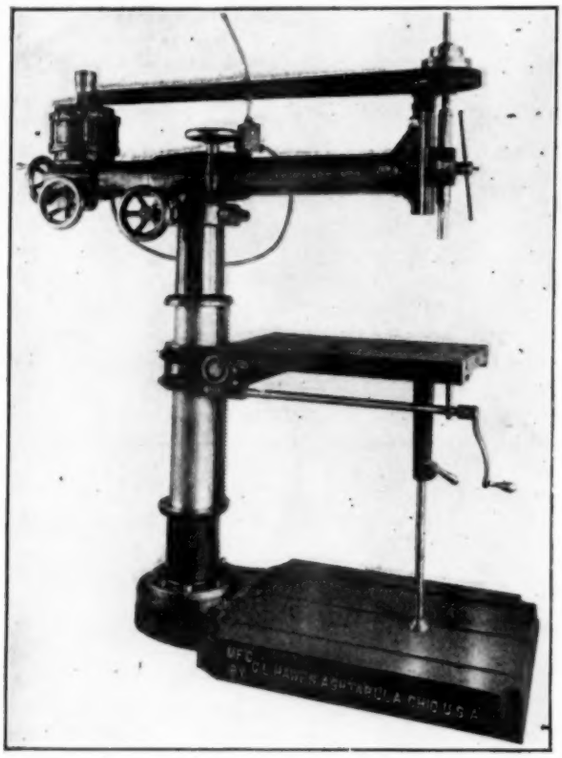


FIG. 2. A PHANTOM VIEW SHOWING THE CONSTRUCTION OF THE PUMP

stant flow in a given direction regardless of the direction of rotation. The standard pumps are furnished with a controlling spring to develop a 25-lb. pressure at 200 r.p.m. and a 40-lb. pressure at 420 r.p.m., but springs to develop either higher or lower pressures can be furnished if required. At present the pumps are made in ½- and ¾-in. sizes, but sizes ranging from ¼ to 2 in. will shortly be furnished.

Hawes Sensitive Radial Drilling Machine

C. L. Hawes, 12 Adams St., Ashtabula, Ohio, is now marketing a sensitive radial drilling machine that has a number of features of interest. It will be noticed that the arm slides through the head of the main column, the advantage of this construction being that the operator does not have to work under the arm, and that the motor, being mounted on the outer end of the arm, keeps the belt at the same tension for all positions of the arm. The position of the motor on the arm can be changed for adjusting belt tension or for setting the motor in the proper position when the belt is on the various steps of the cones. Work can be placed either on the base or on the table, which can be raised or lowered. An outward support is also provided.

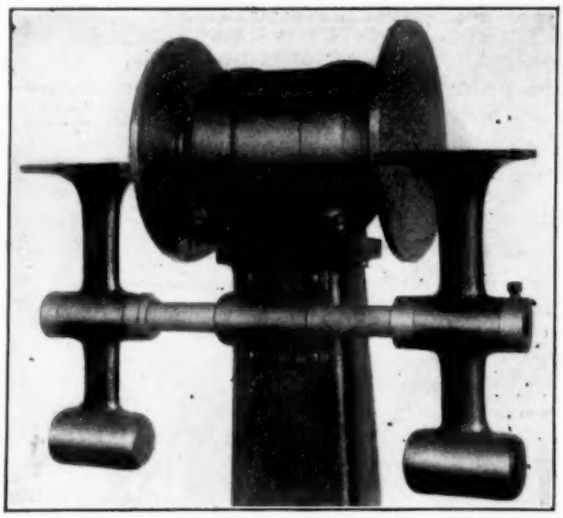


HAWES RADIAL DRILLING MACHINE

Capacity, up to ¾ in.; distance from column to center of drill, 9 in. minimum, 40 in. maximum, distance from base to end of spindle, 47 in.; finished surface of base, 24 x 34 in.; T-slots in base, 3; size of table, 16 x 29 in.; T-slots in table, 3; travel of table, 18 in.; diameter of largest pulley on spindle cone, 10 in.; net weight, 2300 lb.

Forbes & Myers Electric Double Disk Grinding Machine

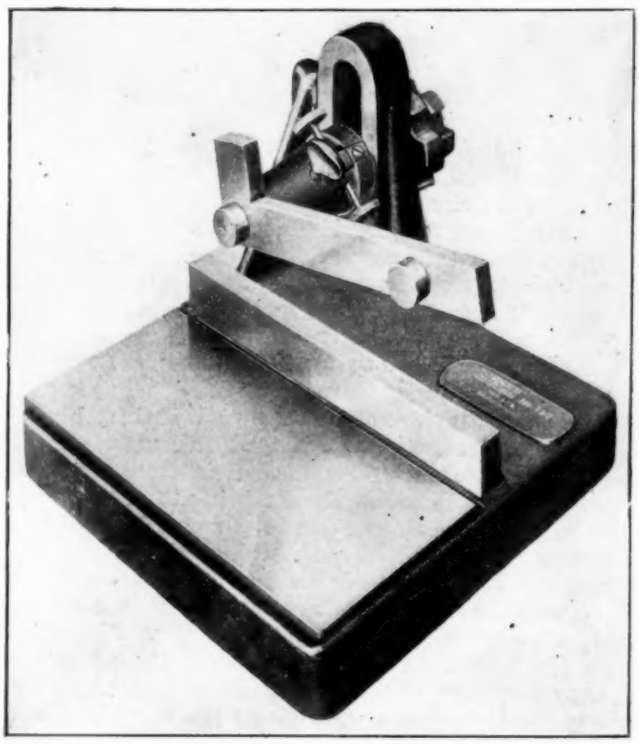
Forbes & Myers, 172 Union St., Worcester, Mass., has just placed on the market a new motor-driven disk grinding machine that is claimed to be simple, reliable, and convenient. The disks are 12 in. in diameter and run at a speed of 1800 r.p.m. The tables furished are of the swinging type but setscrews are provided so that these can be held stationary if desired. The motor is of 2 hp. and is fully inclosed, the spindle running on Hess-Bright ball bearings protected from dust or grit and packed in grease for lubrication purposes. The motor can be supplied for either two- or three-phase current, 25 or 60 cycle, of any voltage.



FORBES & MYERS ELECTRIC DOUBLE DISK GRINDING MACHINE

Taft-Peirce Improved Sine-Bar Fixture

The illustration shows the improved sine-bar fixture being manufactured by the Taft-Peirce Manufacturing Co., Woonsocket, R. I. In the original fixture the sine bar was raised or lowered, as well as rotated by loosening a clamping nut at the rear of the pivot extension



TAFT-PEIRCE IMPROVED SINE-BAR FIXTURE

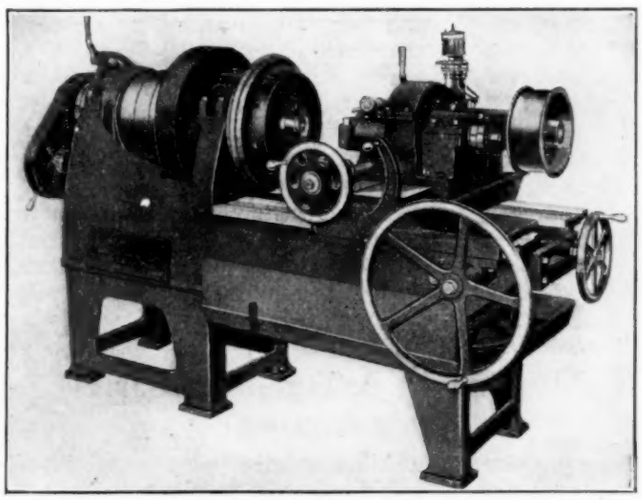
arm, while in the new type two clamping nuts are provided, one of which takes care of raising and lowering the pivot point while the other permits the rotation of the sine bar without changing the height adjustment of the pivot. Another improvement is the incorporation of a positive adjusting device that is mounted on the pivot arm extension, this adjustment consisting of two fine-thread thumb screws and a setscrew. In operation the coarse adjustment is made with the large nuts at the back of the fixture and the final adjustment made with the thumb screws at the front. The setscrew serves to clamp the pivot pin when in final adjustment. Immediately below the sine bar is a similar bar that forms a portion of the base, and by using this bar and the lower face of the sine bar any angle up to 90 deg. can be accurately determined. The top of the base is finished to form a plane at right angles to the front surface of the sine bar, the purpose of this base being to furnish a surface upon which the gage blocks can be placed for setting purposes. It is also possible to reverse the sine bar and clamp it in such a way that it extends beyond the base, this feature being used when it is desired to use the device on a bench plate for measuring special gages or such work. By using box parallels and a bench plate, measurements can be made on large objects and the bar can be rotated through the entire 360 deg. The fixture is so arranged that it can be turned over on its side, which is finished at an angle of 90 deg. to the base. This feature makes it possible to measure the cosine of an angle instead of the sine.

Smalley General No. 24 Thread-Milling Machine

The Smalley General Co., Inc., Bay City, Mich., is now marketing the No. 24 thread-milling machine in the illustration. This is a single-purpose machine, especially adapted for production work, and is designed for three milling speeds only. The machine is similar to the No. 2 manufactured by this company, except the gear box gives 18 changes of speed to the main spindle. The machine will swing work 20 in. in diameter. The maximum distance from the face of the main spindle to the face of the milling spindle on the regular sized bed is 20 in. Any length of bed can be provided and the machine will mill either internal or external right- or left-hand straight or tapered threads. The bed is of the lathe type and has the main head cast integral with it, thus insuring rigidity and alignment. The slow rate of revolution of the main spindle is obtained by planetary reducing gear set inclosed in an oil-tight case driven by gear from the three-step cone. Chucks of any type can be bolted to the flange of the main spindle or draw-in. collet chucks can be furnished if desired for work up to 3½ in. in diameter.

The bottom slide moves on the ways of the machine and carries the top or cross-slide that is controlled in its relation to the bottom slide by a micrometer screw, this serving to control the diameter of thread cut. The top slide carries the milling spindle which is either direct driven for light threads or back geared for a heavier run of work. The spindle bearings are 2¾ in. in diameter and 6 in. long and the milling hob is held on this spindle by means of a tapered arbor and draw-in bolt. All slides are provided with taper gibs. The machines can be furnished for either belt or motor drive as desired. After being used, the cutting lubricant falls into a steel pan below the shears and then drains into a settling basin at the bottom of the pan, from where it is taken by a reversible pump with flexible metallic connections back to the work. The machine is equipped with grease cups and self-closing oil cups, the milling spindle and back gears being lubricated by an oiler located within easy access and sight of operator. The slides are provided with wipers to keep them clear of chips.

The unique feature of the machine is the feed-tube and lead-screw device which controls the lead on the thread to be milled. Some of its important advantages are that the dragging backward action against the thread of the lead screw prevents backlash; the 13 in. of thread on the lead screw gives longer life, greater accuracy and larger production; and the thread can be picked up at any time or place.



SMALLEY GENERAL NO. 24 THREAD-MILLING MACHINE

Capacity, work 9-in. outside diameter, 13-in. inside diameter with 2-in. hob; swing over bed, 20 in.; maximum distance from end of main spindle to end of milling spindle, 22 in., longer bed furnished if desired; changes of threads on chucking type, 21, from 3½ per inch up; milling speeds, 3; floor space, 3 ft. 7¾ in. by 9 ft. 1 in.; hole through main spindle, 6 in.; standard taper in milling spindle, No. 11 B. & S., No. 13 optional; approximate horsepower required, 4; approximate weight, 2600 lb.

"Gray's" Sheet-Metal Cutters

The illustrations show two "Gray's" sheet-metal or plate-cutting machines manufactured by the W. J. Savage Co., Inc., Knoxville, Tenn. Fig. 1 shows the No. 0 bench machine that is used for cutting sheets or plates up to and including ⅛ in. in thickness. It is stated that this machine will cut sheets or plates to any shape without springing or buckling the material. The cutting members consist of a reciprocating member that operates up and down continuously when the clutch is thrown in; a horizontal stationary knife; and the two lower feed rollers which in conjunction with the knife practically form a three-sided die. The upper feed roller, acting under spring compression, holds the stock in the proper position, and an intermittent feeding of both lower and upper rollers advances the stock in regular steps while the reciprocating member cuts the kerf, leaving a square uncrimped edge on the material. The feed is under the control of the operator and it is possible to stop or start at any desired point and to follow a line scribed on the material. The feed is controlled independently of the cutting device, this feature permitting the operator to gage his work with precision. It is stated that very complicated work

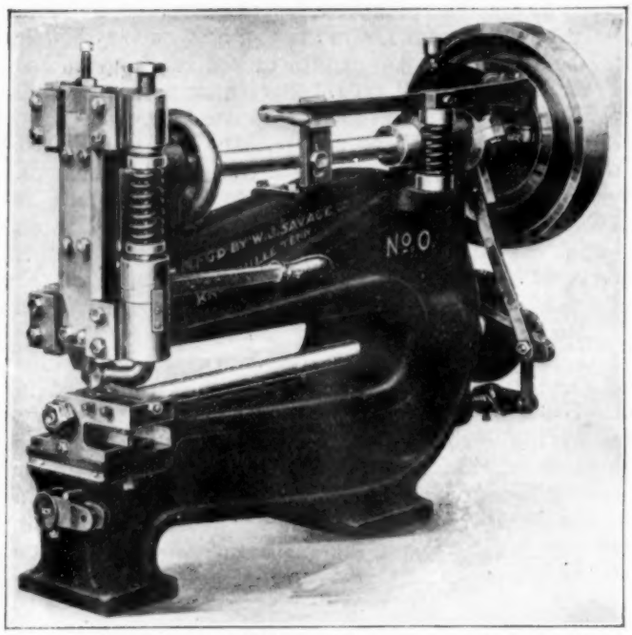


FIG. 1. "GRAY'S" BENCH TYPE NO. O SHEET METAL CUTTER

Capacity, plate up to ¼ in. in thickness; diameter of drive pulley, 12 in.; face of drive pulley, 2½ in.; speed for general work, 300 r.p.m.; maximum speed, 400 r.p.m.; length of feed per revolution, 5/64 in.; cutting speed per minute at 350 r.p.m., 12 in.; width of belt, 2 in.; depth of thread, 18 in.; width, 12 in.; length over all, 39 in.; height, 24½ in.; horsepower required to operate, ¼ to ½; net weight, 361 lb.

can be cut, and another feature cited is that the patterns can be laid out very close together on the sheet of metal, the only space required between them being the thickness of the reciprocating knife. This machine will handle work up to ⅛ in. in thickness and has a depth of throat of 18 inches.

Fig. 2 shows the No. 1 machine which has a capacity for stock up to 3/16 in. thick, with the adjustable circle-cutting attachment. This attachment is designed to cut circles, disks, rings, etc., from 8 to 48 in. in

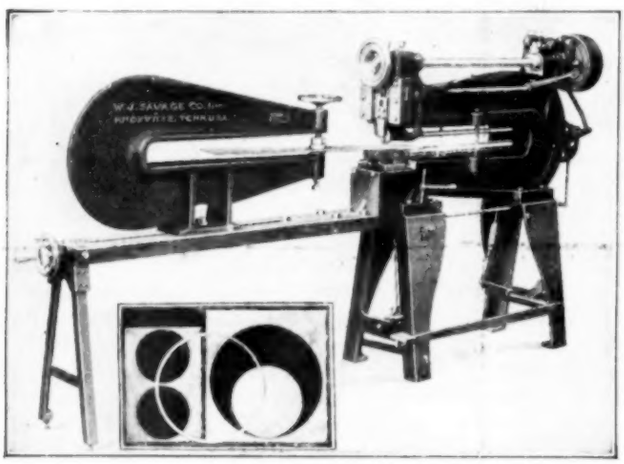
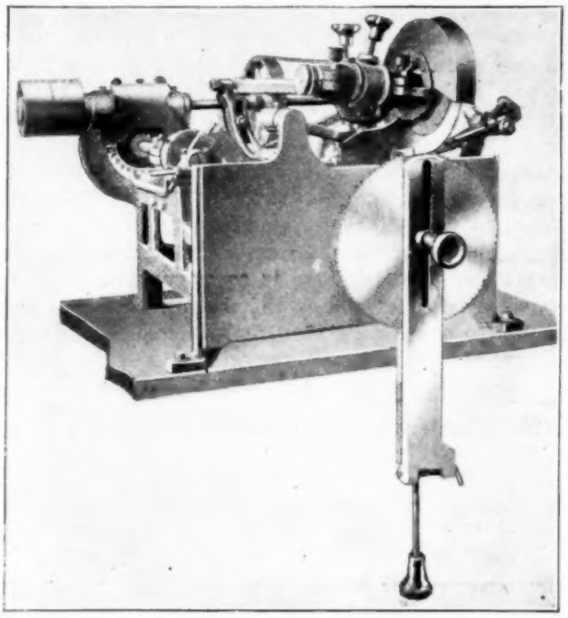


FIG. 2. THE NO. 1 SHEET AND PLATE CUTTER EQUIPPED WITH ADJUSTABLE CIRCLE-CUTTING ATTACHMENT

diameter, without the necessity of laying out or without punching or drilling a hole in the center of the sheet. The plate is clamped between two flat centers and although held against sliding can be turned in order to cut the circle or ring design. The device will cut circles of any size from 8 to 48 in. in diameter, but attachments can be furnished for larger diameters on special order if desired. A simpler attachment is also furnished where it is permissible to punch or bore a hole in the center of the plate, this attachment using a pin on which the plate turns while the circle is being cut. Either style can be quickly set for the required size.

Wardwell Model E Saw Grinding Machine

The saw-grinding machine illustrated is a product of the Wardwell Manufacturing Co., 110 Hamilton Ave., Cleveland, Ohio. This machine is known as the company's Model E, is supplied in either bench or floor type, and is designed for sharpening screw-slotting saws, slitting saws, and cold saws ranging from 1½ to 18 in. in diameter, with teeth varying in size from



WARDWELL GRINDING MACHINE FOR SCREW-SLOTTING AND SLITTING SAWS

36 to the inch to 2 in. from point to point. The saws can be sharpened, the action being entirely automatic, at a speed of 45 teeth per minute, and it is claimed that the teeth are resharpened to within 0.0005 in. alike. A scaled, slotted eccentric permits of quick adjustment of the feed, and a double-pawl positive feed movement gives a continuous feed to the saw, even when teeth are broken away. The machine can be furnished for either belt or motor drive, as desired. In operation, the grinding wheel passes down the face of a tooth to the gullet and up over the back of the next tooth. It is claimed that resharpened saws are of longer life than the original saws, owing to the fact that the scale is broken through and removed.

Polishing In A Tumbling Barrel

BY I. E. PEARCE

The practice of tumbling wooden parts in pieces of scrap sandpaper is an old one with novelty woodenware manufacturers.

We recently borrowed this idea in tumbling some small punchings, but instead of using sandpaper we tore up the remains of old emery belts and grinding disks. The burrs were not only removed but the resulting polished surface added materially to the final japanned finish which they received.

A Plan for the Prevention of Industrial Dispute

By EDWARD WILLIAMS

THERE is no one plan for representation of workers that can be cited as being adaptable to each and every business. The beneficial results to be obtained by the use of various schemes, plans or ideas, will and do vary, increasing in proportion to the spirit of fairness shown by the management or, inversely, with the lack of that spirit. A general method, therefore, adaptable to any organization, which will bring the management and the worker closer together, is of interest to all.

It would seem that a good name for our plan of representation of workers would be "industrial democracy," although this, as everyone knows, is not new. It has been in operation in different forms, in various plants for a number of years with success. But the entire question resolves itself into the two fundamental principals of confidence and square deal.

Confidence might be described as the cornerstone of industrial democracy, and I do not mean that confidence must exist only between the brains and brawn of an organization. It must also exist between employer and employee if the best results are to be obtained. A business composed of 500, 5000 or 50,000 employees may be likened to a strong man. The man's brain is like the management of a company, and his muscles like the employees. The brain does the thinking, planning and directing, as does the management, and the muscles perform the work, as do the workmen. Each must work in harmony with the other and no organization can hope to have harmony or receive the full coöperation of its employees, unless the golden rule is practiced.

Keeping Down Labor Turnover

Labor turnover acts in two ways. In order that the employees of any concern may be as contented as possible with their working conditions, it is essential in the first place to keep the percentage of labor turnover as low as possible. The reason for this is clear. The mere fact that the personnel of an organization keeps changing constantly, acts like a barometer. It indicates clearly to the workmen that the spirit of unrest is in the heart of his shopmates, and if this is the case, it is not long ere it affects him. On the other hand, if the personnel is constant it indicates that the men are satisfied with their surroundings, that they receive fair treatment at the hands of the management, and has a tendency to make the employees more loyal and with less desire to change.

In referring to changes in the personnel, I mean unnecessary changes brought about by faulty employment methods, poor workmanship, bad working conditions, low rates, etc. Such changes cause expense that can, to a great extent, be avoided.

With the effect of the labor turnover practically eliminated from the workmen's minds, it becomes easier to establish the proper spirit toward the management. Some companies have found it to their advantage to take out group insurance for their men, insuring each employee after one year's service for $500 and increasing this insurance $100 per man per year. This provides protection for a workman's family as long as he retains his position, but if he leaves his employer, the insurance is cancelled automatically. If he develops a case of wanderlust at any time, the pressure brought to bear by the arguments set forth by the women folks at home, is generally enough to prevent a man from leaving his position without a very good reason.

Statistics show there is a waste in the United States of over one billion dollars each year, caused by labor turnover, 75 per cent. of which could be saved by proper and effective plans. Large sums of money are also spent each year on account of industrial strife. In addition to this, the cost of production is also much higher than is necessary, by reason of the fact that so few employees attain the proper degree of efficiency. A plan, therefore, which will eliminate these excessive costs, establish the best possible degree of harmony between employer and employee, and reduce to the minimum industrial disputes, is what we are striving for.

As stated before, any plan, to be successful, must be based on "confidence between the management and its employees" and a "square deal." And this plan should be applicable principally to supervisors such as superintendents, and foremen, to produce the best results. It should impress upon them the importance of proper management of men, and that more can be accomplished by leading than by driving, more by coöperation than antagonism.

A careful analysis of conditions shows the most important things desired by employer and employee to be about as follows:

The employer wants: (1) Industrial peace; (2) improvement in quality and quantity of production; (3) reduction in cost of production; (4) higher efficiency on the part of the employee; (5) attentiveness and interest of the worker in his work and in his shopmates; (6) loyalty and confidence on the part of the employee.

The employee wants: (1) Higher wages; (2) better personal relations; (3) good working conditions; (4) a square deal; (5) steady work.

These wants can only be atained by coöperation, confidence and patient persistence on the part of both the employer and employee. To achieve these objects, the following steps are suggested:

(1) Train and develop supervisors into what might be termed "human engineers"; (2) select and fit the employee for his work; (3) educate the employee in the best and most efficient methods of performing his work; (4) appoint a man, preferably an executive to act as manager of industrial relations; he to perform the duties suggested by his title, such as instructing supervisors in the policies of the company, following up suggestions, etc.; (5) hold periodical meetings of supervisors, at which the plans, methods and means for securing the results desired will be described by men of experience; (6) appoint subcommittees to work in conjunction with the manager of industrial relation, and to attend to the following matters: (a) employment, (b) welfare work, (c) service, (d) safety; (7) render proper recognition in some practical way to the supervisors and others who accomplish good results along the lines indicated, thus giving them a definite personal and monetary interest in the progressive work of the various departments.

The steps outlined, if properly followed, should in most organizations, result in materially reducing labor turnover, and in amicably adjusting any misunderstandings that arise. They should increase the efficiency of employees, reduce absenteeism and produce larger financial returns for both employer and employee.

Sparks from the W

American Commissioner from Turkey Here for Conferences

Lewis Heck, American Commissioner at Constantinople, Turkey, is now in New York City to confer with representatives of American firms interested in extending their export trade in the Levant.

Since the signing of the armistice, there has been a great desire on the part of individuals and firms in Turkey to secure American products. In view of the fact that Constantinople will be favorably situated for trade distribution to the Black Sea regions and ports in the Levant, there is every reason to indicate that the United States will have a bigger share of the trade with the Near East than before the war. At the present time, there is a great demand in Turkey for the following materials: agricultural machinery, light automobiles, tractors, chemicals, lubricating oil, leather, cheap hardware and tools of all kinds. When the country is settled, there will also be a great demand for construction materials.

Before the war, imports into the United States from Turkey greatly exceeded our exports to that country, and there is now a unique opportunity of turning the balance of trade in our favor.

Mr. Heck, who will be at the local offices of the Bureau of Foreign and Domestic Commerce, Room 734, Customhouse, during his stay in New York, will be pleased to confer with representatives of American firms interested in trade with Turkey and other points of the Levant Appointments may be made by letter.

* * *

Association of British Driving Chain Manufacturers

The unprecedented demands of the Allied Governments for driving chains for all purposes during the period of the war made it necessary for the British driving chain manufacturers to collaborate in order to use the whole of their resources to the best advantage. As a result, the needs were met, both as regards quantity of production and quality of product. The benefits accruing from coöperation were so marked that a permanent association has now been formed.

The main object of the association is to foster and develop the use and application of chain gearing, the value of which is not yet fully appreciated by power users. In view of this, and in face of competition with other forms of transmission, it is the policy of the association to keep down the cost of chain driving to the user. This will be attained by: (1) Standardization of chains, wheels, and chain wheel cutters, to ensure interchangeability; (2) elimination of unnecessary sizes of chains, which have been a source of confusion and difficulty to the user; (3) the increase in output resulting from the above; (4) the more comprehensive research made possible by coöperation.

* * *

General Motors Co. Is Planning $5,000,000 Automobile Works

Building permits have been issued in St. Louis for the construction of buildings costing $2,500,000 for the General Motors Co. About $750,000 has been paid for 3000 x 2500-ft. site, the buildings will cost $2,500,000, the machinery $1,500,000 and accompanying improvements $250,000. There will be two assembling plant buildings, each 750 ft. long by 300 ft. wide, with an administration structure 120 x 40 ft., each three stories high, of fireproof construction. The $1,500,000 mechanical equipment for manufacturing has been ordered to produce Chevrolet and Buick motor cars. Architects and engineers' plans provide for the construction of additional units to double the $5,000,000 plant within the next 12 months.

* * *

Public Sale of an Industrial Plant and Machinery

By direction of the United States District Court the receivers of the C & C Electric & Mfg. Co., a corporation of New Jersey located at Garwood, will be sold at public sale on Monday, Aug. 4, at 12 o'clock noon, on the premises.

The sale will consist of the following: (1) The land, building, and building equipment; (2) machinery, and machine tools; (3) patterns, drawings, jigs and dies, patents, etc., and the good will of this corporation. Joseph P. Day, 31 Nassau St., New York City, is the auctioneer.

* * *

U. S. Timber Use Said To Be Three Times Production

Proposing use of steel railroad ties, E. H. Clapp of the Forestry Service told a House committee recently that the country's timber consumption had become three times the production and that at the present rate of cutting the American forest capacity was falling off about sixty billion feet annually.

H. P. Douglas, chief engineer of the Chicago & Alton, said mechanical wear and not decay was the great roadbed destructive agency now. The cost of ties, he said, had trebled in the last few years.

The committee is considering a resolution for investigation of the cross-tie problem.

Pusey & Jones To Organize a Ship Repair Plant

Christopher Hannevig, president Pusey & Jones, with shipbuilding plants at Gloucester City, N. J., and Wilmington, Del., is considering the organization of a new company, to be known as the Pennsylvania Ship Repair Plant, with capital of about $3,000,000, to build three new drydocks adjoining the shipyards at Gloucester City, with shops and construction buildings to form a complete repair works for vessels of all kinds. The proposed drydocks will be 10,000, 6000 and 3000 tons capacity, respectively. The new works will be operated in conjunction with the local shipyard. The plant has 11 shipways and it is planned to utilize four of these ways in the future for normal operations, as soon as the Emergency Fleet Corporation relinquishes the plant. The yard will specialize in the construction of steel cargo carriers, with capacity of 13,000 tons upward.

* * *

C. W. Hare, Director of Sales, Gone to Europe

C. W. Hare, Director of Sales, War Department, after conferring with Assistant Secretary of War Crowell, in New York, sailed on Wednesday, July 21, with his party on the Imperator. One of the purposes of the trip, according to the War Department, is to ascertain whether there is a European market for the surplus properties now held by the War Department in the United States. It was also stated at the War Department that Mr. Hare's commission will not conflict in any way with the activities of the Liquidation Commission that is now in Europe.

* * *

Copper Production in 1918

The advance statistics of the 1918 output of copper, issued by the U. S. Geological Survey and compiled by B. S. Butler, show that the smelter production was 1,908,533,595 lb., as compared with 1,886,120,721 lb., in 1917, an increase of 22,412,874 lb. The output of refined copper was 2,476,077,401 lb., as against 2,507,663,067 lb. in 1917 This is a decrease of 31,585,666 lb Stocks of copper on Jan. 1, 1919 are put at 180,000,000 lb. or 66,000,000 lb. more than on Jan. 1, 1918. The apparent domestic consumption in 1918 was 1,661,669,576 lb., as compared with 1,315,670,803 lb. in 1917 and 812,268,639 lb. in 1913. Exports of metallic copper were 744,429,741 lb., against 1,126,875,368 lb. in 1917 or 100,000,000 lb. less than the 1913 exports. Imports in 1918 were 576,000,000, against 556,000,000 lb. in 1917.

World's Industrial Forge

By E.C.Porter, News Editor

The Melbourne, Australia, Technical School

John Miles of Keilor, Australia, a contributor to *American Machinist*, has sent to this office a prospectus of the Melbourne (Australia) Technical School, the Working Men's College, incorporated to "improve the education of those who work, and especially to promote technical education and to facilitate the attainment of a knowledge of handicrafts, arts, sciences and languages by the establishment of classes, workshops, laboratories, reading-rooms and libraries."

While the college is essentially a workman's school, as its name implies, and teaches all the trades and mechanic arts, the higher arts and sciences are by no means neglected and the prospective student may choose from a variety of subjects, including the higher mathematics, engineering, chemistry, law, music, art, etc.

The college is under the direction of the principal and a council of 22 members, and the teaching staff numbers nearly one hundred. Students are received from the ages of 12 to 16 years, according to the subjects chosen, and special provisions are made for working apprentices who desire to make a more intimate study of their trade. Both day and evening classes are provided and the tuition fees are nominal.

* * *

Convention Railway Foremen

The annual convention of the International Railway General Foremen's Association will be held from September 2 to 5 inclusive, at the Hotel Sherman, Chicago, Ill.

Domestic Exports of Metal-Working Machinery from the United States by Counties During May, 1919

Countries	Lathes	Other Machine Tools	Sharpening and Grinding Machinery	All Other Metal Working Machinery
Belgium	$41,528	$14,200	$40,324	$134,633
Denmark	1,561	9,483	5,371	
France	77,251	257,444	93,094	943,324
Greece	250	335	.....	15,560
Iceland and Faroe Islands	250	.....	.....	.....
Italy	4,722	5,162	3,317	192,901
Netherlands	64,415	5,657	12,876	51,393
Norway	2,211	4,838	1,742	18,522
Spain	11,034	15,342	4,958	62,315
Sweden	6,507	15,399	3,442	25,926
Switzerland	2,042	9,465	3,175	24,895
England	131,139	182,442	17,821	304,356
Scotland	.....	14,861	.....	5,000
Canada	.....	64,156	25,296	124,462
Guatemala	.....	.....	.....	64
Nicaragua	.....	356	.....	.....
Panama	.....	756	.....	375
Salvador	.....	382	.....	28
Mexico	1,529	4,276	284	453
Newfoundland and Labrador	.....	234	10	192
Jamaica	2,187	261	75	.....
Trinidad and Tobago	.....	103	210	36
Cuba	13,101	22,446	1,633	21,049
Danish West Indies	480	95	.....	.....
Dutch West Indies	.....	47	.....	.....
French West Indies	.....	532	.....	2,034
Haiti	510	45	.....	.....
Dominican Republic	52	88	.....	848
Argentina	3,880	4,266	70	9,749
Bolivia	.....	132	.....	1,448
Brazil	51,760	12,463	1,935	55,589
Chile	99	2,315	124	9,225
Colombia	213	699	54	162
Ecuador	.....	8	5	.....
British Guiana	17	.....	.....	78
Dutch Guiana	.....	.....	.....	145
Peru	198	1,920	4,337	19,937
Uruguay	.....	2,152	148	96
Venezuela	.....	177	.....	191
China	7,630	3,383	3,360	35,344
British India	12,735	11,872	4,768	41,440
Straits Settlements	3,031	790	.....	4,371
Other British East Indies	281	1,687	182	192
Dutch East Indies	19,353	9,850	343	11,015
French East Indies	.....	.....	.....	488
Hongkong	726	1,142	122	6,367
Japan	29,824	74,739	23,165	356,031
Russia in Asia	.....	3,067	.....	33
Siam	.....	147	.....	43
Australia	2,563	34,586	2,796	22,036
New Zealand	2,698	4,395	376	3,703
Other British Oceania	.....	.....	.....	126
French Oceania	.....	.....	20	6,427
Philippine Islands	9,412	7,132	554	10,198
Belgian Kongo	.....	.....	.....	5,363
British South Africa	7,878	15,336	104,990	30,914
French Africa	.....	60	140	.....
Portuguese Africa	.....	168	.....	7
Total	513,067	820,891	396,977	2,559,084

Trade Currents From Chicago and Cleveland Districts

CHICAGO LETTER

Labor troubles in Chicago and vicinity seem to have no power to cause any let-up in the machine-tool trade, which continues on the comfortable basis established in the past three months. No dealers have any spectacular sales to talk about but each one is doing just about all the business he can handle. This business, consisting of orders for single items or, at most, three or four items, is so widely diversified in kind that every sort of tool is covered, and these small orders amount to a surprising aggregate.

Normally, July is an "off" month in this line, but sales so far recorded and inquiries received indicate that instead of the annual slump, this month will equal or exceed any of the preceding six months with most dealers. Of the various strikes concerning which so much has been printed in the daily papers, there are only two of any size which affect large users of machinery. These are the International Harvester Co., which has resulted in a complete lock-out on two Chicago plants, and Crane Co., where from 5000 to 7000 men have been out for two weeks.

Large Corporations Are Filling Their Requirements

The Chicago Pneumatic Tool Co. has made public a list of tools desired for their plant at Franklin, Penn., and several other large corporations are beginning to fill their requirements. The tendency seems to be, however, to make purchases piece-meal rather than through the medium of lengthy lists furnished for quotations to the entire trade.

Various tendencies are combining to influence an increase in price in many lines of heavy tools. It seems to be definitely established that raw materials will be no cheaper, labor costs are decreasing nowhere and are increasing in many places, and tentative inquiries for export business are having an optimistic effect on manufacturers. Some makers cut prices a little too sharply a few months ago, anticipating cost reductions that failed to work out. Point is given to these observations by a letter sent to dealers this week by a large maker of milling machines, in which he states that an increase is surely coming, and that orders already placed, for stock, must be considered as subject to the increased price when it comes.

The great bulk of business now being closed is on new machinery, the majority of buyers being comparatively small concerns wanting new equipment

only. This can be only a temporary condition, however, particularly if the threatened price increase goes into effect.

CLEVELAND LETTER

Although there are no spectacular developments in the machinery field here as the midsummer season arrives, there is a larger amount of business being closed than the most sanguine of manufacturers and dealers had hoped for two months ago. This is accounted for, according to leading interests, by the fact that general manufacturing continues to improve, and while no large orders are pending or even hinted at, a considerable quantity of small equipment is being absorbed in moderate-sized orders. During the last week added impetus has been given to the industry by the entrance of new automobile interests who are rounding out their equipment. There is no abatement in the demand for automobiles, it is pointed out, and a continuance of business from this quarter alone will keep all plants pretty well rushed, it is claimed.

While most of the business at the moment is now confined to local or nearby requirements, there is a marked increase toward the end of this month in the number of inquiries on export account. At present little of this business is coming from former warring countries, but rather from those nations that can aid in rebuilding the war area. Punches, shears and similar equipment are named largely in these inquiries, indicating a need for general manufacturing purposes.

NO DROP IN PRICES LOOKED FOR

One factor that is said to be stimulating the demand at present is the anticipation of still higher prices. Both manufacturers and dealers here do not look for a drop in values for a long time, and are prepared for still further increases. This is the prime factor in bringing business up to 20 per cent. better than in previous normal summer seasons.

Construction of what will be, when completed, one of the most complete plants for the manufacture and distribution of furnace-men's, roofers', tinners' and similar supplies and equipment, in the Middle West, was begun this week here by the J. M. & L. A. Osborn Co. The new plant will be at the intersection of Superior Ave., East 38th St. and Pennsylvania R.R. The site has been selected because it is considered the center of industry of the Cleveland district. When completed the building will give the firm twice as much floor space as at present at Superior Viaduct and West 11th St. The main building will be 342 x 180 ft., three stories high. A feature of the construction will be a floor capacity of 600 lb. per square foot—said to be the heaviest yet designed for a plant of this kind in Cleveland. Several new lines will be added upon the opening of the new plant, including bars, heavy plates and perhaps rounds. A private garage, to house cars of members of the firm and their associates during the day and trucks at night will be a feature. The new plant is expected to be ready by Jan. 1. It will cost more than half a million dollars. Officers of the company are: President, J. F. Reichert; vice president, T. J. Strong; treasurer, W. W. Lutton; secretary and general manager, A. W. Howe.

The Next Lyons Fair

The Lyons Fair, opened for the first time in March, 1916, has become such an institution and is so largely attended that it has been found necessary to divide it into two parts, the next exhibition being from Oct. 1 to Oct. 15, 1919. This exhibit is devoted to industrial supplies, general engineering and including most of the mechanical activities. The motor industry, clock and watch making, firearms and ammunition, the aircraft industry and technical schools are assigned to the Spring Fair, which is from Mar. 1 to Mar. 15.

The total number of exhibitors has grown from 1342 in 1916 to 4700 in March, 1919, while the number of foreign exhibitors has increased from 143 to 1600 at the spring exhibition.

The exhibition is not held in the large buildings to which we are accustomed, but in stalls which are mostly wooden removable booths erected in rows along the squares and embankments of the town. They are all alike, the inside measurements being 13 ft. x 13 ft. 2 in., giving an area of about 20 sq.yd. Partitions are provided but can be removed when larger spaces are desired.

Special concrete stalls have been built for exhibits of heavy machinery or material, these measuring 10 ft. 8 in. x 17 ft. 3 in., giving the same area as the other stalls. All are fitted with locks and keys which are delivered to the exhibitors on their arrival.

The cost is 800 francs per stall, no reduction being allowed if several stalls are used by the same exhibitor. The stalls are each supplied with a 50-candle power lamp in the ceiling and a plug for a 32-candle power table lamp; current for these two lamps being included in the rental. A limited amount of electric current can be had for power, but as the power supply is not large, it is necessary to make arrangements for this as early as possible.

The heating of the wooden stalls must in most cases be done by means of oil stoves as there is a shortage of gas and electric current in Lyons. Stoves and fuel must be provided by the exhibitor. The concrete stalls are heated by hot water and a fixed charge, depending on the price of coal at the time of the fair, will be made to all exhibitors. The stalls in the new permanent exhibition palace which is being erected to house future fairs, are heated either by gas or electricity.

Further information can be secured from Ernest Perrin, United States official representative of the Lyons Fair, 3 Park Row, New York City.

Standardization Work of British Machine Tool Association

The executive committee of the Machine Tool Association of England held its meeting on June 25, and decided to recommend to the British Engineering Standards Association that they should ask the American mechanical engineers to adopt the same standards for T-slot cutters as those which may be ultimately decided upon for England.

The Standard Association will also be asked to make a preliminary investigation into the standardization of gears. Further, arising out of a letter from the World Trade Club, it was resolved that in the opinion of the committee the adoption of the metric system was not practicable on account of the enormous expenditure involved.

Personals

R. HUNTER, 154 West 38th St., New York is now representing the Oshkosh Manufacturing Co., manufacturers of tools and machinery.

ELLIOTT REID, formerly assistant to the general manager of the Westinghouse Lamp Co., has been appointed to the position of sales manager for that company.

CARL G. DAHLQUIST, formerly foreman of the Industrial Engineering Co., Detroit, Mich., has been appointed master mechanic.

T. W. CARLISLE, of the Strong-Carlisle-Hammond Co., who has been in war service as a major, has returned to civilian pursuits, and has resumed his position as treasurer of the company.

H. E. HENRY, formerly general sales manager of the Fulflo Pump Co., Blanchester, Ohio, has resigned to take up the duties of sales and advertising manager for the Michigan Machine Co., Detroit, Mich.

J. S. HOWER, formerly with the Philadelphia branch of the Fairbanks Co., has been appointed assistant to George S. Pierson and transferred to the New York specialty division on mill, mine and railroad specialties.

Business Items

The Bartlett-Haywood Co., of Baltimore, is installing apparatus for the manufacture of piston rings.

The Kramer Woodworking Co., 4th St. and Lehigh Ave., Philadelphia, has gone into the manufacture of steel shop furniture.

The Walter A. Zelnicker Supply Co. of St. Louis has added 2000 sq.ft. to its present office space at 325 Locust St., St. Louis, Mo. This is estimated to be an increase of 33⅓ per cent.

(Continued on Page 246b)

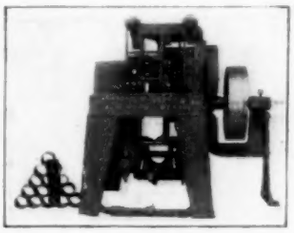
Condensed-Clipping Index of Equipment

Clip, paste on 3 x 5-in. cards and file as desired

Bending Machine, No. 29

Kane & Roach, Niagara and Shonnard Sts., Syracuse, N. Y.

"American Machinist," July 10, 1919

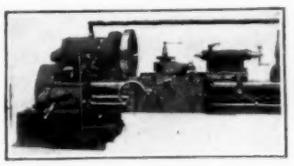


For small circles such as are shown on the floor in the illustration. Made in several sizes so as to handle any range of work. The difference between the maximum and minimum sizes of work that can be handled on one machine is from 1 in. to 1¼ in., depending on the size of the work. The work is bent into a complete circle from end to end, without leaving any straight or flat spots. The rolls are supported at both ends and driven, the upper one being so arranged that it will raise and release so the finished cylinder can be pulled off the end. Adjustment for different thicknesses of material is provided for so that the same stock does not have to be used at all times. Built to make cylindrical work as small as 2 in. in diameter.

Lathes, Geared-Head

Bradford Machine Tool Co., Cincinnati, Ohio.

"American Machinist," July 10, 1919

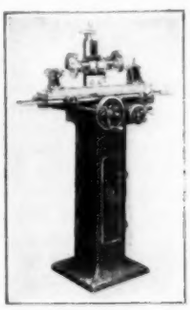


Sizes made, 14, 16, 18, 22, 24, 26, 28, 30 and 32 in. with actual swings over the beds of 14⅞, 16¼, 20¼, 22⅝, 25¼, 27, 28⅝, 31¼ and 32⅝ in. respectively. Made for either motor or belt drive, the motor or pulley being mounted at the rear on the base of the machine close to the floor. The driving mechanism is located beneath the bed and operates through a selective-speed gear box, through a silent chain drive to the spindle. Gear shifts through the selective gears in the speed box can only be effected by momentarily disengaging the drive. Twelve spindle speeds may be obtained as well as corresponding reverse speeds. The spindle is mounted in adjustable, taper, bronze bearings and extends through the hood to permit the use of drawbars and tubes for draw-in attachments. For special work a ball thrust bearing may be provided if desired. The tailstock is of the overhanging type, permitting the use of the compound rest at right angles when turning work of small length.

Grinding Machine, Universal

Draper & Hall Co., Middletown, Conn.

"American Machinist," July 10, 1919



Adapted for use on milling cutters, reamers, counterborers, taps, dies, end mills, arbors, etc. and also for internal and surface grinding. The table is supported its entire length by the longitudinal slide. The head swivels to any desired angle, and the machine can be changed from cylindrical to surface work in one minute. The slide rests its entire length on the column, and the swivel table rests its full length on the slide and is provided with a screw adjustment for accurately aligning the centers. One end of the table is graduated for taper per foot and the other end in degrees in order to facilitate setting for taper work. The spindle is of tool steel, hardened, ground and lapped and runs in split phosphor-bronze bearings provided with means for compensation for wear. Swing on centers, 9 in.; longitudinal feed, 18 in.; vertical feed, 8 in.; distance between centers, 15 in.; crossfeed, 7 in.; top of platen, 26 x 4 in.; weight, 750 lb.

Speed Reducers, Spur-Gear

W. A. Jones Foundry and Machine Co., 4401-4451 West 12th St., Chicago, Ill.

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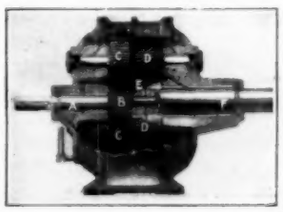
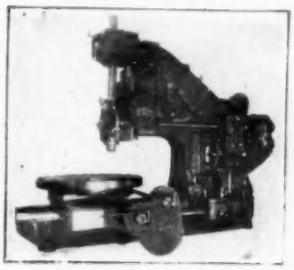


The illustration shows the single-type speed reducer used for reductions up to 15 to 1, but a double-type is made for ratios from 15 to 200 to 1. The construction details do not differ materially. The high-speed shaft A and pinion B are forged from one piece of nickel steel, the shaft running in a bronze bearing at the left end and in a bronze bushing in the low-speed shaft at the right end. This pinion B meshes with and drives the three gears C that are mounted integral with the three pinions D which drive the low-speed gear E and the shaft F. The gears C and pinions D are equally spaced around the high- and low-speed gears at angles of 120 deg., this construction relieving both high- and low-speed shafts and bearings of all transverse loads due to tooth thrust.

Milling Machine, Vertical Spindle

Newton Machine Tool Works, Inc., 23rd and Vine Sts., Philadelphia, Penn.

"American Machinist," July 10, 1919

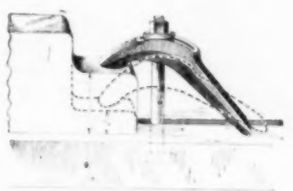


Diameter of spindle through driving gears, 6 in.; diameter of spindle in main bearings, 6⅜ in.; diameter of table on working surface, 60 in.; diameter of table over pan, 66½ in.; crossfeed, 65 in.; in-and-out feed, 50 in.; maximum height from table top to under side of frame and vertical spindle, 44½ in.; vertical traverse of spindle, 24 in.; distance from center of spindle to frame, 50 in.

Clamps

Albert O. Mathison, 196 Carleton St., New Britain, Conn.

"American Machinist," July 10, 1919



These clamps are curved and are made in four sizes with overall lengths 10, 8, 6 and 4 in. Each clamp has a washer or bearing block having a curved under surface that fits the curve on the back of the clamp, the bolt passing through this bearing block with the nut resting on top. This feature allows the clamps to be used over a range of 4 in. without the use of blocks under the rear end, and it is also claimed that the clamps will hold work that is out of square or tapered. The thickness of the clamps is 1⅛ in. and the width of slot is ¾ in.

Steel, High-Speed Casting Alloy, "Chrobaltic"

Chrobaltic Tool Co., Railway Exchange, Chicago, Ill.

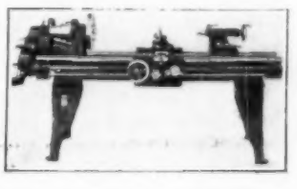
"American Machinist," July 10, 1919

It is stated that this alloy can be cast into intricate shapes, and that it is suitable for milling cutters and other tools having multiple cutting edges, as well as for blanking, drawing and forming dies, hot and cold trimmers, and any variety of other tools that may be cast close to shape and thus avoid high machining cost. It is also stated that the castings have the appearance of good smooth forgings, that they are practically non-rusting and acid resisting and that their grain is uniform and dense. The steel may be hardened in oil or air and the process of annealing and rehardening can be repeated many times without deterioration in quality. Tools made of this material do not change their shape in hardening.

Lathe, Back-Geared

Union Lathe Works, York, Penn.

"American Machinist," July 10, 1919



Swing over bed, 16¼ in.; swing over carriage, 11⅛ in.; hole through spindle, 1 5/16 in.; taper in spindle, Morse, No. 3; diameters of cone, 7½, 6¼, 4⅞ and 3⅝ in.; lengths of bed, 6, 7, 8, 10 and 12 ft. with distances between centers of 35, 48, 60, 84 and 108 in. and weights of 1715, 1790, 1865, 2015 and 2265 lb. respectively.

Patented Aug. 20, 1918

The Philadelphia Machine Co., a new firm in Philadelphia and located at 1130 Race Street, recently purchased planing machines and engine lathes from the Monarch Machinery Co., 300 North 3rd St., Philadelphia.

The Chicago Pneumatic Tool Co. has moved its Minneapolis office from the Metropolitan Bank Building to Fifth Ave. and Fifth St., South Minneapolis, where it will carry a stock of pneumatic and electric tools, air compressors, oil engines, rock drills and parts.

The Crystal Alloys Corp. has been succeeded by the United Broach and Machine Co. The new company is continuing the manufacture of alloy broaches and is also engaging in the production of broaching appliances, tools, fixtures and special machinery in general.

Julius Blum & Co., 510-512 West 24th St., New York, has leased the premises at 532-540 West 22nd St., New York, for a long term of years; its present facilities being inadequate for its business. The office and warehouse will be reconstructed to fit its requirements.

Fire of undetermined origin has damaged the plant and machinery of the Crescent Brass Manufacturing Co. to the extent of $70,000. Plans for immediate rebuilding are being discussed by directors, according to Charles H. Hofrichter, president of the company.

The National Tool Co., Cleveland, Ohio, recently opened a New York sales office in charge of E. S. Chamberlain at Room 553, 50 Church St., New York, N. Y. The Philadelphia office of this company has been changed from 11 N. Sixth St. to 40 N. Seventh St. This branch is in charge of H. L. Mather.

George F. Bowen, president of the G. F. Bowen Machine Co., Newark, N. J., and Otto R. Kihm, mechanical engineer of the Edgewater plant of the American Can Co., have purchased the Cort Engineering Co., of Newark, N. J., and will undertake the building of medium and heavy machinery.

The Simplex Tool Co., Woonsocket, R. I., is increasing its manufacturing facilities by adding 8000 sq.ft. of floor space and installing additional machine tools. This company has just increased its capital to $250,000, and will specialize on contract machine and tool work, toolroom specialities and machine tools.

The corporate name of the Lewis F. Shoemaker & Co. has been changed to the Shoemaker-Satterthwait Bridge Co.; the change is in the title only, the management remains unchanged. The company has a manufacturing plant at Pottstown, Penn., and office at 2 South 15th St., Philadelphia, Penn. and 256 Broadway, New York City.

Elliott & Stephens Machinery Co., St. Louis, Mo., has succeeded Marshall & Huschart Machinery Co., in the St. Louis territory. Mr. Elliott was formerly manager of Marshall & Huschart Machinery Co. at St. Louis and Mr. Stephens was for several years affiliated with Colcord Wright Machinery and Supply Co. The new company is at present located at Chemical Building, Eighth and Oliver Sts., St. Louis, Missouri.

Articles Needed in Holland

There is a demand for the following articles at the present time in Holland: In the machinery line there is needed machines for coal mining, food preservation (such as drying apparatus for potatoes and other vegetables), machinery for textile industries and for sugar-refining plants, and also locomotives. Standard electrical goods are also in demand. There is need of lighting installations, telephone material, accumulators, and benzine motors to run small dynamos.

There is great need of hardware, including builders' hardware, hinges, bolts, wood screws, metal screws, door closers, galvanized iron and brass wire, varnished or galvanized wire fences, windlasses and metal cables, pulleys, chains, and tools such as nippers, screwdrivers, augers, bits and braces, and sets of tools. Also shovels and pitchforks.

At the annual meeting of the stockholders of the Hart-Parr Co., Charles City, Iowa, the following directors were elected : C. G. King, Chicago, Ill.; C. W. Hart, Hedgesville, Mont.; C. D. Ellis, M. W. Ellis, N. Frudden and Walter Dray, Charles City. C. D. Ellis was reëlected president; W. R. Dray, vice president and general manager; and Albert H. Witt, secretary and treasurer. It was stated that the company will have all Government work cleared off the floors during the ensuing month and thereafter tractors will be given the main consideration.

The Norton Co., Worcester, Massachusetts, manufacturers of Alundum and Crystolon grinding wheels and other abrasive products have announced the opening of a store in Detroit, Mich., at 73-75 West Congress St. The store and the service department are to be managed by C. W. Jinnette, who has been the Norton Co.'s representative in Detroit for a number of years. The sales and demonstrating force will consist of Waldo E. Whiting, William T. Cushing, Lucien Gay and Dean Wheatley, all of whom have had a special training course at the Worcester plant and experience in laboratory and sales work.

The Page Steel and Wire Co. has opened a branch office in Chicago at 29 South LaSalle St. This office will handle all Armco iron products, including Armco iron welding rods, twisted pairs, plain and galvanized strand, bond wires, Armco iron fence and barbed wire and other brands of fence manufactured by the Page Steel and Wire Company. This company has another new branch office in the Book Building, Detroit. Distribution in Canada is in the hands of Taylor & Arnold, Ltd., Montreal, Toronto, Winnipeg. The sales of the Armco iron department are under the supervision of W. T. Kyle, sales manager at 30 Church St.. New York.

The annual meeting of the stockholders of the Rickert-Shafer Co. was held July 2, 1919 in the office of the company. The management reports that business for the first six months ending June 30, 1919 has equalled the sales of the corresponding period of 1918. The company is contemplating the erection of another wing to the factory building, which will be of steel and brick, 33 x 150 ft., two floors. Orders for a number of new machine tools have been placed, but the bulk of the machine-tool requirements will not be ordered until the building is completed. The company is giving the hardening department its first consideration and will install only modern equipment.

The Cutler-Hammer Manufacturing Co., Milwaukee, has recently opened an office in Detroit, located at 905 Kresge Bldg., to expedite the handling of orders and to give the company's customers in and about Detroit better engineering service. The Detroit office is, in reality, a branch of the Chicago office and bears the same relation to it as the Cincinnati office. H. S. Kinsley, who is in charge at Detroit, has taken with him from the Chicago office, C. W. Greenman and M. Dugliss, both of whom were recently mustered out of service. This trio will form the nucleus for the Detroit organization. Prior to going to Chicago, several years ago, Mr. Kinsley was connected with the engineering department at the Milwaukee plant.

Announcement has been made by I. T. Kahn, president of the Republic Structural Iron Works Co. and of the Columbia Hardware Co., Cleveland, Ohio, of the purchase of the Taylor & Boggis Foundry Co., of that city, by a new company of which he is the head. Others in the new company are J. C. Hostleter, vice president, and T. L. Sidlo, treasurer. Both of the latter are law partners of Secretary of War Baker. The Taylor & Boggis Foundry Co. name will be retained, and the business conducted from the old plant. C. J. Morgan, president, H. J. Boggis, vice president, and B. F. Wade, treasurer, have retired from the business. The Taylor & Boggis Foundry Co. was organized in 1865 and incorporated in 1883. Its specialty has been manufacturing hardware and heavy castings.

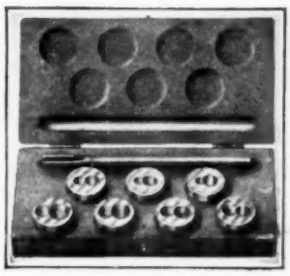
The Steel Products Co., Cleveland, Ohio, has completed arrangements for enlarging its output in Michigan by the purchase of new property at Detroit, according to C. E. Thompson, president of the company. The property of the Parker Rust Proof Co., has been taken over and will be altered during the summer. Possession will be taken about Sept. 15, and enlarged capacity will follow soon thereafter. The Cleveland plant will continue operating as at present.

Condensed-Clipping Index of Equipment

Clip, paste on 3 x 5-in. cards and file as desired

Stud-Bolt-Wrench Set,
Keller Tool and Machine Co., Eau Claire, Wis.
"American Machinist," July 10, 1919

For the removal of stud bolts which cannot be otherwise removed without damage to the bolt. These sets are made in two sizes, the smaller containing wrenches to fit stud bolts from ¼ to ⅝ in. in diamter in steps of 1/16 in., while the larger set is made for four sizes of bolts, ⅝, ¾, ⅞ and 1 in. in diameter. In operation, the larger opening of the ring is slipped over the stud bolt and the grooved end of the wrench bar is inserted in the other opening, after which an ordinary wrench can be applied to the outer end of the wrench bar and the bolt screwed out in the ordinary manner.



Furnace, Rotary End-Heating
Standard Fuel Engineering Co., 1646 Woodward Ave., Detroit, Mich
"American Machinist," July 10, 1919

For hardening the ends of tools and other steel parts in which a local application of heat is desired. The lower part of the furnace body consists of a revolving table on which the pieces to be heated are to be laid, the ends projecting into the heating chamber. The operator stands in front of the furnace where one segment of the heating chamber is removed. Small tools or other pieces of steel may be heated all over by placing them on that part of the hearth that travels through the heating chamber. The heating chamber itself has a vertical cross-section of 4 in. wide and 4½ in. high, and the height of the opening through which the tools project into the furnace is 1¼ in. The height to the table is 36 in. and the outside diameter of the machine is 45 in.

Reamer, Adjustable Shell
Cashman Tool Co., Waynesboro, Penn.
"American Machinist," July 17, 1919

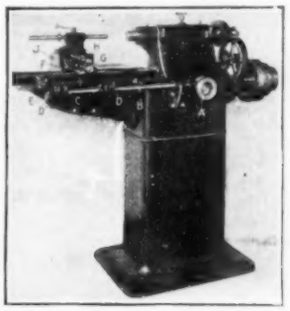
These reamers consist of three parts: the body, the lock collar, and the adjusting screw, in addition to the blades, which are adjusted backward instead of forward by a single adjusting screw graduated to indicate changes of size of 0.001 in. The adjusting screw has a right-hand thread, while the lock collar has a left-hand thread, the one interlocking with the other. A single wrench is provided, one end for use with the adjusting screw and the other end with the lock collar. The blades are provided with a lip that prevents chatter and are said to afford a wide range of accurate adjustment. All parts are made interchangeable.

Rivet Heater, Electric, "Berwick"
American Car and Foundry Co., Berwick, Penn.
"American Machinist," July 17, 1919

Manufactured in four sizes. No. 1 having a capacity of 600 rivets per hour, with diameters from ½ to ⅝ in. and lengths up to 2 in.; No. 2 having a capacity of 500 rivets per hour, with diameters from ½ to ⅝ in. and lengths up to 3½ in.; No. 3 having a capacity of 300 rivets per hour, with diameters from ⅝ to ¾ in. and lengths up to 4½ in., and No. 4 having a capacity of 150 rivets per hour, with diameters from 1¼ to 1⅜ in. and lengths up to 10 in. The machines are portable and are connected to alternating-current circuits. It is stated that the power required is 20 kw.-hr. per 100 lb. of rivets regardless of the size. In operation, after the switch is closed the pedal is pressed and the rivets put in place as shown, each one being removed when the proper temperature has been reached.

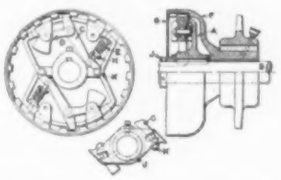
Oil Grooving Machine
Fischer Machine Co., 310-316 N. 11th St., Philadelphia, Penn.
"American Machinist," July 10, 1919

An improved form of the oil-grooving machine previously manufactured. The former machine would cut oil grooves on cylinders or in bores in a straight line parallel to the axis, in a circle in a plane at right angles to the axis and also around a bearing in a plane at an angle to the axis. The new machine, however, is so arranged that the cutting tool may be thrown out of operation part of the time, making it possible to cut grooves, in the form of a cross, in a straight line parallel to the axis, or in the form of a half, whole or double spiral around the cylinder or bore. Another feature of the machine is that the taper bearings can be grooved.



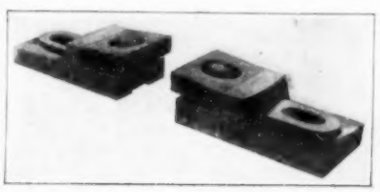
Release, Mechanical Overload "Lettgo"
Link Belt Co., Chicago, Ill.
"American Machinist," July 17, 1919

Will automatically disengage the driving from the driven machinery if the load exceeds a predetermined amount. Spider A, keyed to shaft B, has triggers C pivotally mounted on the links D with the ends engaging notches in the drum F and rollers K. The springs E, regulated to any desired pressure by the adjusting nuts H, hold the ends of the triggers on the rollers K, under normal conditions, but when the drive is overstressed the compression of the springs will permit the ends of the triggers to release rim F and allow the driven machine to stop. To set the triggers in the driving position, the collar J is provided with fingers that engage the pins on the lower ends of triggers C. By turning this collar with a spanner wrench, the triggers are moved to the original position, and the outer ends at the same time enter notches in the drum F, thus renewing the transmission connection. Cover G, fitting the end of the drum F, incloses and protects the mechanism.



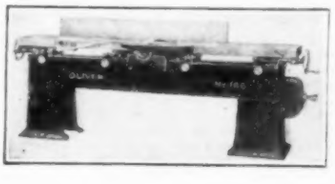
Clamps, "Never Loose"
Keller Tool and Machine Co., Eau Claire, Wis.
"American Machinist," July 17, 1919

The character of these clamps is shown in the illustration. They may be bolted to a machine table and form a ready means of securing pieces of work. The hardened-steel jaws which rock in a socket in the base piece are drawn down against the work by the concealed-head setscrews which may be seen in the center of the jaws. In this manner the clamp not only provides a secure stop which prevents the work from sliding sidewise, but at the same time when the jaws are drawn down tightly the work is held firmly against the face of the table.



Planing and Jointing Machine, No. 166
Oliver Machinery Co., Grand Rapids, Mich.
"American Machinist," July 17, 1919

A direct motor drive is used, the machine operating at 3600 r.p.m. on 3-phase, 60-cycle, 220-volt alternating current. The cylinder is of the three-knife type, the outer end being shaped to receive the rotor. The stator is held by an adapter, attached to the frame of the machine, and by the outer end cover.



Patented Aug. 20, 1918

The Weekly Price Guide of

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co., as per Department of Commerce Committee Schedule.

CINCINNATI	
No. 2 Southern	$29.80
Northern Basic	27.55
Southern Ohio No. 2	28.55
NEW YORK—TIDEWATER DELIVERY	
Penna. 2X	31.90
Virginia No. 2	31.15
Southern No. 2	33.95
BIRMINGHAM	
No. 2 Foundry	25.75
PHILADELPHIA	
Eastern Pennsylvania No. 2	30.65
Virginia No. 2	30.85
Basic	29.90
Grey Forge	29.90
Bessemer	31.85
CHICAGO	
No. 2 Foundry local	27.25
No. 2 Foundry, Southern	31.75
PITTSBURGH, INCLUDING FREIGHT CHARGE FROM VALLEY	
No. 2 Foundry	28.15
Basic	27.15
Bessemer	29.35

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York Current	New York One Month Ago	New York One Year Ago	Cleveland Current	Cleveland One Year Ago	Chicago Current	Chicago One Year Ago
Structural shapes	$3.47	$4.07	$4.15	$3.37	$4.20	$3.47	$4.20
Soft steel bars	3.37	3.97	4.45	3.27	4.20	3.37	4.10
Soft steel bar shapes	3.37	3.97	4.45	3.27	4.20	3.37	4.10
Soft steel bands	4.07	4.57	4.995	....	....	....	....
Plates, ¼ to 1 in. thick	3.67	4.27	4.495	3.57	4.20	3.67	4.45

Note—For less than carload lots add 4½c. per 100 lb.

BAR IRON—Prices per 100 lb. at the places named are as follows:

	Current	One Year Ago
Mill, N. Y.	$2.62	$3.50
Warehouse, New York	3.37	4.70
Warehouse, Cleveland	3.22	4.10
Warehouse, Chicago	3.37	4.10

STEEL SHEETS—The following are the prices in cents per pound from jobbers' warehouse at the cities named:

	New York Pittsburgh, Mill, in Carloads	New York Current	New York One Month Ago	New York One Year Ago	Cleveland Current	Cleveland One Near Ago	Chicago Current	Chicago One Year Ago
*No. 28 black	4.35	5.50	5.62	6.495	5.27	6.42	5.37	6.52
*No. 26 black	4.25	5.40	5.52	6.395	5.17	6.32	5.27	6.42
*Nos. 22 and 24 black	4.20	5.35	5.47	6.345	5.12	6.27	5.22	6.37
Nos. 18 and 20 black	4.15	5.30	5.42	6.295	5.07	6.22	5.17	6.32
No. 16 blue annealed	3.75	4.77	4.77	5.695	4.67	5.62	4.77	5.72
No. 14 blue annealed	3.65	4.67	4.67	5.595	4.57	5.52	4.67	5.62
No. 10 blue annealed	3.55	4.57	4.57	5.495	4.47	5.47	4.57	5.52
*No. 28 galvanized	5.70	7.20	7.42	7.745	6.62	7.67	6.97	7.77
*No. 26 galvanized	5.40	6.90	7.12	7.445	6.32	7.37	6.67	7.47
No. 24 galvanized	5.25	6.75	6.97	7.295	6.17	7.22	6.52	7.32

* For painted corrugated sheets add 30c. per 100 lb. for 25 to 28 gage; 25c. for 19 to 24 gage; for galvanized corrugated sheets add 15c.; all gages.

COLD DRAWN STEEL SHAFTING—From warehouse to consumers requiring at least 1000 lb. of a size (smaller quantities take the standard extras) the following discounts hold:

	Current	One Year Ago
New York	List	List plus 13%
Cleveland	5% off	List plus 13%
Chicago	2% off	List plus 13%

DRILL ROD—Discounts from list price are as follows at the places named:

	Extra	Standard
New York	45%	40%
Cleveland	35%	35%
Chicago	35%	35%

SWEDISH (NORWAY) IRON—The average price per 100 lb., in ton lots is:

	Current	One Year Ago
New York	$21.00–26.00	$15.00–19
Cleveland	20.00	20.00
Chicago	16.50	19.00

In coils an advance of 50c. usually is charged.
Domestic iron (Swedish analysis) is selling at 15c. per lb.

WELDING MATERIAL (SWEDISH)—Prices are as follows in cents per pound f.o.b. New York, in 100 lb. lots and over:

Welding Wire		Cast-Iron Welding Rods	
⅛, 5/32, 3/16, ¼, 5/16, ⅜ No. 8, 7/32 and No. 10	21.00 to 30.00	1/16 by 12 in. long	14.00
		⅛ by 19 in. long	12.00
¼ No. 12		¼ by 19 in. long	10.00
5/16, No. 14 and 7/32 No. 18 No. 20		⅜ by 21 in. long	10.00
		Special Welding Wire, Coated	
		⅛	33.00
		5/32	30.00
		3/16	8.00

Domestic 20c. for 1/16, 15c. for ⅛ to 3/16.

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York Current	Cleveland Current	Chicago Current
Openhearth spring steel (heavy)	7.00	8.00	8.00
Spring steel (light)	10.00	11.25	11.75
Coppered bessemer rods	8.00	8.00	7.07
Hoop steel	4.07	4.75	4.07
Cold-rolled strip steel	8.40	8.25	8.10
Floor plates	5.67	6.00	5.92

Note—For less than carload lots add 4½c. per 100 lb.

PIPE—The following discounts are for carload lots f.o.b. Pittsburgh: basing card of National Tube Co. for steel pipe, Cardry A. M. Byer's Co. for iron, both dated Mar. 21, 1919.

BUTT WELD

Inches	Steel Black	Steel Galvanized	Inches	Iron Black	Iron Galvanized
⅛, ¼ and ⅜	50½%	24%	⅜ to 1¼	39½%	23½%
½	54½%	40%			
¾ to 3	57½%	44%			

LAP WELD

2	50½%	35%	2	32½%	18½%
2½ to 6	53½%	41%	2½ to 6	34½%	21½%

BUTT WELD, EXTRA STRONG PLAIN ENDS

⅛, ¼ and ⅜	46½%	29%	½ to 1¼	39½%	24½%
½	51½%	39%			
¾ to 1¼	55½%	43%			

LAP WELD, EXTRA STRONG PLAIN ENDS

2	48½%	37%	2	33½%	20½%
2½ to 4	51½%	40%	2½ to 4	35½%	23½%
4½ to 6	50½%	39%	4½ to 6	34½%	22½%

Stock discounts in cities named are as follows:

	New York Black	New York Galvanized	Cleveland Black	Cleveland Galvanized	Chicago Black	Chicago Galvanized
⅛ to 3 in. steel butt welded	47%	31%	43½%	34½%	57½%	44%
2½ to 6 in. steel lap welded	42%	27%	45½%	30½%	53½%	41%

Malleable fittings. Class B and C, from New York stock sell at list +12½%. Cast iron, standard sizes, 10% off.

METALS

MISCELLANEOUS METALS—Present and past New York quotations in cents per pound, in carload lots:

	Current	One Month Ago	One Year Ago
Copper, electrolytic	21.75	15.37½	26.00
Tin in 5-ton lots	70.00	72.50	94.00
Lead	5.50	5.25	5.05
Spelter	8.00	6.05	8.62½
ST. LOUIS			
Lead	5.25	5.00	7.75
Spelter	7.65	6.20	8.37½

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

	New York Current	New York One Month Ago	New York One Year Ago	Cleveland Current	Cleveland One Year Ago	Chicago Current	Chicago One Year Ago
Copper sheets, base	29.50	22.50	42.00	33.50	38.00	36.50	33.00
Copper wire (carload lots)	26.00	23.00–28	47.50	29.50	35.00	25.00	33.50
Brass sheets	23.00	23.75–28	39.125	29.00	37.00	28.00	31.50
Brass pipe	34.00	34.00–37	39.00	36.00	40.00	37.00	41.50
Solder (half and half) (case lots)	45.00	46.50–41	45.00	41.00	62.00	41.00	70.00

Copper sheets quoted above hot rolled 16 oz., cold rolled 14 oz. and heavier, add 1c.; polished takes 1c. per sq.ft. extra for 20-in. widths and under; over 20 in., 2c.

BRASS RODS—The following quotations are for large lots, mill, 100 lb. and over, warehouse; net extras:

	Current	One Year Ago
Mill	$19.00	$32.25
New York	21.50	34.25
Cleveland	30.00	35.00
Chicago	30.00	29.50

Shop Materials and Supplies

ZINC SHEETS—The following prices in cents per pound prevail:

Carload lots f. o. b. mill 11.00

	In Casks		Broken Lots	
	Current	One Year Ago	Current	One Year Ago
Cleveland	12.95	18.75	13.30	18.40
New York	12.00	16.50	13.00	17.00
Chicago	16.50	22.00	16.00	21.50

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots, for spot delivery, duty paid:

	Current	One Year Ago
New York	8.37½	13.35
Chicago	11.00	13.50
Cleveland	10.75	16.00

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	New York		Cleveland		
	Current	One Year Ago	Current	One Year Ago	Chicago
Copper, heavy and crucible	16.75	23.50	20.00	24.00	21.00
Copper, heavy and wire	15.75	22.50	19.50	23.00	20.50
Copper, light and bottoms	13.50	20.50	17.00	21.00	19.00
Lead, heavy	4.62½	7.00	5.25	7.00	5.125
Lead, tea	3.75	5.25	3.50	5.50	4.00
Brass, heavy	10.00	14.75	14.00	16.50	20.00
Brass, light	8.00	11.00	11.00	12.50	12.00
No. 1 yellow brass turnings	9.00	13.00	12.00	14.00	12.00
Zinc	4.25	6.25	5.50	6.50	6.00

ALUMINUM—The following prices are from warehouse at places named:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb	33c.	32.00c.	33½c.

COPPER BARS from warehouse sell as follows in cents per pound, for ton lots and over:

	Current	One Year Ago
New York	25.00	42.00
Chicago	28.00	38.00
Cleveland	33.00	36.50

BABBITT METAL—Warehouse price per pound:

	New York		Cleveland		Chicago	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Best grade	90.00	125.00	80.00	108.00	75.00	100.00
Commercial	50.00	70.00	18.50	23.00	15.00	24.00

SHOP SUPPLIES

New York prices will be revised in next weeks issue.

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York		Cleveland		Chicago	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Hot pressed square	$3.25	+$2.50	$2.25	$1.40	$2.00	$1.05
Hot pressed hexagon	2.70	+2.50	2.25	1.20	2.00	.85
Cold punched hexagon	3.25	+2.50	2.25	.75	1.30	1.00
Cold punched square	2.70	+2.50	2.25	.75	1.30	1.00

Semi-finished nuts sell at the following discounts from list price:

	Current	One Year Ago
New York	50-10%	40%
Chicago	50%	50%
Cleveland	60-10-10%	60%

MACHINE BOLTS—Warehouse discounts in the following cities:

	New York	Cleveland	Chicago
¾ by 4 in. and smaller	60-10%	50%	50-10%
Larger and longer up to 1¼ in. by 30 in.	50-10%	40%	40-10%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:

New York.....$1.25 Cleveland.....$3.75 Chicago.....$2.25

For cast-iron washers the base price per 100 lb. is as follows:

New York.....$6.00 Cleveland.....$3.75 Chicago.....$4.00

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
¾ by 6 in. and smaller	50-10%	40-5%	50%
Larger and longer up to 1 in. by 30 in.	45-5%	37½%	50-5%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets		Burs	
	Current	One Year Ago	Current	One Year Ago
Cleveland	20%	List plus 10%	10%	List plus 10%
Chicago	20%	List price	20%	List price
New York	40%	20% from list	20%	10½% from list

RIVETS—The following quotations are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel ½ and smaller	65%	60%	45%
Tinned	65%	60%	40%

Boiler, ¾, ¾, 1 in. diameter by 2 in. to 5 in. sell as follows per 100 lb.:

New York...$4.10 Cleveland...$4.00 Chicago....$4.87 Pittsburgh...$4.65

Structural, same sizes:

New York...$4.00 Cleveland...$4.10 Chicago....$4.97 Pittsburgh...$4.75

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	34.00	38.00	38.50
Brass	33.00	36.00	37.00

For immediate stock shipment 3c. is usually added. The prices, of course, vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 2c.; for lots of less than 75 lb., but not less than 50 lb., the advance is 5c. over base (100-lb. lots); for less than 50 lb., but not less than 25 lb., 10c. should be added to the base price; and for quantities of from 10 to 25 lb. the extra is 25c.; less than 10 lb., add 35c.

Double above extras will be charged for angles, channels and sheet-metal mouldings if ordered in above quantities. The above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ¼ up to 2 in. inclusive in rounds, and ½ up to 1½ in., inclusive in square and hexagon—all varying by thirty-seconds up to 1 in. and by sixteenths over 1 in. On all shipments aggregating less than 100 lb. there is usually a boxing charge of $1.50.

LONG TERNE PLATE—For No. 28 primes, from Stock, the price in Chicago is $7.50 per 100 lb.

COTTON WASTE—The following prices are in cents per pound:

	New York		Cleveland	Chicago
	Current	One Year Ago		
White	13.00	11.00-13.00	14.00	11.00 to 14.00
Colored mixed	9.00 to 12.00	8.50-12.00	11.00	9.50 to 12.00

WIPING CLOTHS—Jobbers' price per 1000 is as follows:

	13½ x 13½	13½ x 20½
Cleveland	52.00	58.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$1.75	$1.75	$1.75
Philadelphia	1.75	1.75	1.75
Cleveland	2.75	2.75	2.40
Chicago	2.00	2.00	2.25

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$3.65	$3.65	$4.30
Cleveland	3.62	3.62	4.60
Chicago	4.12½	4.50	4.00

COKE—The following are prices per net ton at ovens, Connellsville, and cover the past five weeks:

	July 17	July 10	July 3	June 26	June 19
Prompt furnace	$4.00	$4.25	$4.25	$4.00	$4.00
Prompt foundry	5.00	5.00	5.00	4.50	4.50

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	per ton	$8.00
Cleveland	375-lb. bag	2.50

LINSEED OIL—These prices are per gallon:

	New York		Cleveland		Chicago	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Raw in barrels (5 bbl. lots)	$2.15	$1.86	$2.15	$2.00	$2.53	$1.97
5-gal. cans	2.28	1.96	2.40	2.15	2.73	2.17

WHITE AND RED LEAD—Base price per pound:

	Red				White	
	Current		1 Year Ago		Current	1 Year Ago
	Dry	In Oil	Dry	In Oil	Dry and In Oil	Dry and In Oil
100-lb. keg	13.00	14.50	14.00	14.50	13.00	14.00
25 and 50-lb. kegs	13.25	14.75	14.25	12.75	13.25	14.25
12½-lb. keg	13.50	15.00	14.50	15.00	13.50	14.50
5-lb. cans	15.00	16.50	.....	.....	15.00	16.00
1-lb. cans	16.00	17.50	.....	.....	16.00	17.00

500 lb. lots less 10% discount; 2000 lb. lots less 10-2½% discount.

NEW *and* ENLARGED SHOPS

Consult the Buying Section when in need of machinery or supplies

Metal Working

NEW ENGLAND STATES

Conn., Bridgeport—The Bridgeport Hardware Manufacturing Co., 461 Iranistan Ave., plans to build a 2 story, 20 x 150 ft. factory. Estimated cost, $25,000. Fletcher, Thompson, Inc., 1089 Broad St., Engr.

Conn., Bridgeport—The Cornwall & Patterson Manufacturing Co., 1730 State St., manufacturer of piano and organ hardware, has had plans prepared by W. R. Briggs, Arch., 1115 Main St., for a 1 story, 40 x 100 ft. addition to its factory, to be erected on Bedford St. Estimated cost, $23,000.

Conn., Bristol—The American Silver Co., 2 Riverside Ave., has awarded the contract for the erection of a 3 story, 32 x 190 ft. factory. Estimated cost, including equipment, $75,000.

Conn., Hartford—The Arrow Electric Co., 99 Hawthorne St., will build a 2 story, 50 x 200 ft. factory. Estimated cost, $40,000. Ford, Buck & Sheldon, 60 Prospect St., Engr.

Conn., Hartford—A. C. Hine, 314 Pearl St., has awarded the contract for a 3 story, 64 x 306 ft. garage, to be erected on Washington St. Estimated cost, $75,000.

Conn., Hartford—Older & Rosenberg, 1212 Main St., have awarded the contract for the erection of a 4 story, 64 x 128 ft. garage. Estimated cost, $95,000. Noted May 1.

Conn., New Britain—Swift & Ferguson, c/o C. C. Palmer, Arch., 272 Main St., will build a 2 story, 60 x 100 ft. garage. Estimated cost, $30,000.

Conn., Plainville—The Trumbull Electric Manufacturing Co., Woodford Ave., has awarded the contract for the erection of a 4 story, 50 x 106 ft., a 1 story, 60 x 100 ft., and a 2 story, 50 x 150 ft. factories. Estimated cost, $90,000.

Conn., South Norwalk—The Nash Engineering Co., Wilson Road, plans to build a 3 story addition to its plant for the manufacture of vacuum pumps. Estimated cost, $30,000.

Mass., Holyoke—The Cowan Truck Co., Canal St., has awarded the contract for the erection of a 2 story addition to its plant. Estimated cost, $25,000.

Mass., Worcester—B. L. Handelman, c/o C. R. Hoyle, Arch., 1038 Slater Bldg., plans to build a 2 story, 150 x 200 ft. garage on Mechanic St. Estimated cost, $100,000.

Mass., Worcester—The Worcester Paper Box Co., 68 High St., plans to build a 2 story, 60 x 150 ft. garage, on Austin St. and Houchin Ave. Estimated cost, $45,000. S. H. Pitcher Co., 44 Front St., Engr.

MIDDLE ATLANTIC STATES

Md., Baltimore—The L. M. Reinhardt Motor Co., North Ave. and Oak St., has had revised plans prepared by L. Rothchild, Arch., 1225 Sansom St., for a 3 story, 40 x 110 ft. sales and service building. Noted June 26.

N. J., Hoboken—The Palisade Garage Realty Co. is building a 100 x 129 ft. garage on Highpoint Ave. near Summit Ave. Estimated cost, $50,000.

N. Y., Binghampton—The Larrabee-Deyo Motor Truck Co., 23 Washington St., has awarded the contract for the erection of a 1 story service station. Estimated cost, $17,000. The company will install machine tool equipment for its repair department. Noted June 12.

N. Y., New York (Borough of Brooklyn)—C. Broadway Rouse, 545 Broadway, New York City, has awarded the contract for a 1 story, 70 x 100 ft. garage, to be erected at 138-142 Tillery St., here. Estimated cost, $20,000.

N. Y., New York (Borough of Brooklyn)—J. B. Camerdella, 215 Montague St., will build a 1 story, 100 x 125 ft. garage on 4th Ave. and 65th St. Estimated cost, $30,000.

N. Y., New York (Borough of Brooklyn)—The French Builders, 142 East 43rd St., will build a 1 story, 105 x 133 ft. garage on Christopher and East New York Ave. Estimated cost, $35,000.

N. Y., New York (Borough of Brooklyn)—L. Gold, 44 Court St., will build a 1 story, 100 x 100 ft. garage on East 10th St. and Ave. O. Estimated cost, $25,000.

N. Y., New York (Borough of Brooklyn)—B. Stephano Bros., 715 Lorimer St., will build a 1 story, 50 x 100 ft. garage on Richardson and Lorimer St. Estimated cost, $25,000.

N. Y., New York (Borough of Brooklyn)—The Weingeld Realty and Construction Co., 122 Dumont St., will build a 1 story, 100 x 110 ft. garage on Pacific St. and Washington Ave. Estimated cost, $25,000.

N. Y., New York (Borough of Manhattan)—D. Meenan, 1966 Broadway, has awarded the contract for a 6 story, 87 x 100 ft. garage, to be erected at 430-36 West 55th St. Estimated cost, $200,000. Noted June 26.

N. Y., Syracuse—The United States Hoffman Co., Taylor St., manufacturer of machinery, has awarded the contract for the erection of a 2 story, 80 x 200 ft. factory and a 40 x 60 ft. power house. Estimated cost, $100,000.

Penn., Philadelphia — The Hartford Realty Co., c/o L. Rothchild, Arch., 1225 Sansom St., is having plans prepared for a 2 story, 30 x 160 ft. garage, to be erected at 1425 North Broad St. Estimated cost, $20,000. Noted July 17.

SOUTHERN STATES

Ala., Birmingham—I. Adler, 1530 South 11th Ave., will build a garage on Magnolia Ave. and Sycamore St. Estimated cost, $60,000. H. B. Odell, Agent for the Packard Motor Co., 541 Peachtree St., Atlanta, Ga., Lessee.

Ky., Louisville—B. F. Avery & Sons, 7th St., manufacturer of harvesting machines, are having plans prepared by D. X. Murphy & Bro., Arch., 714 Louisville Trust Bldg., for a 1 story, 100 x 150 ft. addition to their forge shop and a 1 story, 100 x 230 ft. factory. Estimated cost, $75,000 and $125,000 respectively. Noted Jan. 16.

Ky., Louisville—The Mattingly-Hubbard Motor Co. plans to build a 4 story, 150 x 200 ft. garage on 3rd St., between York and Breckinridge St. Estimated cost, $100,000.

W. Va., Huntington—J. H. Stevenson is building a 2 story, 40 x 140 ft. garage and automobile repair shop on 4th Ave. Estimated cost, $40,000. Noted Feb. 6.

W. Va., Wheeling—The S. E. Moss Iron Works, 28th and Chapline St., have awarded the contract for a 1 story, 125 x 250 ft. addition to their plant, to be erected on 29th St. Estimated cost, $60,000.

MIDDLE WEST

Mich., Detroit—The Chevrolet Motor Co., 1244 Woodward Ave., will build a 1 story, 106 x 150 ft. service station on York St. near Cass Ave. L. Kamper, 752 Book Bldg., Arch.

Mich., Detroit—The Detroit Pressed Steel Co., Mt. Elliott Ave., will build a 3 story, 184 x 234 ft. factory. A. Kahn, Marquette Bldg., Arch.

Mich., Detroit—The Detroit Steel Products Co., East Grand Blvd., will build a 1 story, 80 x 198 ft. factory. Smith, Hinchman & Grylls, 710 Washington Arcade, Arch.

Mich., Detroit—The Fisher Body Co., Oakland and Piquette Ave., will build a 6 story, 144 x 236 ft. factory and a 2 story, 69 x 125 ft. dry kiln building on Farnsworth and Riopelle St., for the manufacture of automobile bodies. L. Kamper, 752 Book Bldg., Arch.

Mich., Detroit—The General Motors Corporation, Boyer-Campbell Bldg., has awarded the contract for a 6 story, 150 x 150 ft. sales and service building to be erected on York and Cass Ave. Noted Apr. 24.

Mich., Detroit—The Packard Motor Car Co., East Grand Blvd., has had plans prepared by A. Kahn, Arch., Marquette Bldg., for a 3 story, 196 x 201 ft. garage and service station, to be erected on Antoine and Woodbridge St.

Ohio, Cleveland—The Chandler Motor Car Co., East 131st St. and St. Clair Ave., plans to build a 3 story, 80 x 400 ft. addition to its machine shop. Estimated cost, $200,000.

Ohio, Cleveland—The Cleveland Automobile Co., 300 East 131st St., plans to build a 4 story, 80 x 400 ft. addition to its plant, to be erected on Euclid Ave. and London Rd. Estimated cost, $750,000.

Ohio, Cleveland—The Crescent Brass Manufacturing Co., 8410 Lake Ave., plans to rebuild its 3 story, 80 x 120 ft. factory, which was recently destroyed by fire. Estimated cost, $50,000.

Ohio, Cleveland—The P. A. Gier Co., 5112 St. Clair Ave., plans to build a 2 story, 60 x 200 ft. machine shop, at 534 East 105th St. Estimated cost, $75,000.

Ohio, Cleveland—The Krause Battery Co., 3425 West 25th St., has purchased a site on West 25th St. and Scranton Ave., and plans to build a 3 story, 50 x 108 ft. service station. Estimated cost, $50,000.

Ohio, Cleveland—The National Lamp Association of the General Electric Co., Nela Park, has awarded the contract for the erection of a 3 story, 80 x 110 ft. factory. Estimated cost, $200,000.

Ohio, Cleveland—The Union Garage Co., 517 Sloan Bldg., has awarded the contract for a 2 story, 165 x 212 ft. garage, to be erected on West St. Clair Ave. Estimated cost, $400,000. Noted May 29.

Ohio, Columbus—The D. L. Auld Co., 195 East Long St., manufacturer of jewelry and name plates, has awarded the contract for a 2 story, 45 x 390 ft. factory, to be erected on 5th St. and 5th Ave. Estimated cost, $55,000. Noted June 26.

Ohio, Dayton—The Air City Garage and Tire Co., 16 South Jefferson St., has awarded the contract for a 2 story, 80 x 132 ft. garage, to be erected on 5th and Perry St. Estimated cost, $100,000. Noted June 5.

Ohio, Dayton—A company is being organized by E. A. Brenneman, 42 Spirea Drive, and plans to build a factory for the manufacture of farm tractors. Estimated cost, including equipment, $100,000.

Ohio, Dayton—The Custer Specialty Co., 26-28 North Ludlow St., has awarded the contract for a 3 story, 60 x 80 ft. factory, to be erected on Franklin St., for the manufacture of toy automobiles. Estimated cost, $30,000. Noted Apr. 24.

Ohio, Dayton—The Dayton Reliance Tool and Manufacturing Co., 818 East Monument St., has increased its capital stock from $50,000 to $250,000 and plans to build an addition to its plant. Estimated cost, $75,000.